THE EFFICACY OF BRIEF DIGITAL MINDFULNESS INTERVENTIONS ON STUDENT ANXIETY

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JOSHUA A. HEATH

DISSERTATION ADVISOR: DR. JERRELL C. CASSADY

BALL STATE UNIVERSITY

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ABSTRACT

General anxiety disorder has been defined by the DSM-5 as excessive worry characterized by traits such as intrusive thoughts and obtrusive physiological reactions (American Psychiatric Association, 2013). In modern culture, anxiety in academic settings has been reported as a significant problem afflicting an estimated 41% children and undergraduates (Gregor, 2005; von der Embse et al., 2018). Research examining test anxiety prevalence in age ranges from elementary schools to universities has demonstrated that the rates of individuals reporting “high” test anxiety levels vary between 15% and 22% (Ergene, 2003; Putwain & Daly, 2014). Given the high incidence rates observed in schools as well as decades of research demonstrating the negative impact of test anxiety on student performance, a vibrant domain of research has been devoted to understanding and developing interventions designed to reduce adverse outcomes from test anxiety (Ergene, 2003; von der Embse et al., 2018).

Mindfulness, originating from Buddhist philosophy is broadly defined as a present-centered approach to everyday life via purposeful attention to the present moment (Bishop et al., 2004; Brown & Ryan, 2003; Grossman et al., 2004; Kabat-Zinn, 1994; Wolters & Yu, 1996). The present-centered approach has a emphasis of self-compassion, non-reactive awareness, and acceptance (Shapiro et al., 1998). Any individual can attain a mindful state by using several activities, including meditation, yoga, mindful art, and rhythmic breathing (Bazzano et al., 2018; Brown & Ryan, 2003; Carsley & Heath, 2019). Inducing a mindful state is not always a conscious decision, as research has shown it can subconsciously occur (Grossman et al., 2004).

A growing line of intervention research has begun to explore the positive effects mindfulness practices have upon the perceptions of anxiety before and during evaluative situations. Interestingly, the majority of mindfulness intervention research concerning test

anxiety are conducted in K-12 environments. The current investigation found limited research concerning undergraduates test anxiety perception. Between four intervention studies, duration ranged between one week through two months, using either mindful breathing or a variation of MBSR. Each of the studies included reported significantly decreased in test anxiety for intervention groups, as well as increases in trait mindfulness. Additionally, these interventions also revealed effectiveness in improving academic performance and reducing automatic thoughts. Finally, support was provided for digital interventions with one study reporting no significant differences between in-person or digital delivery methods (Cho et al., 2016; Hjeltnes et al., 2015; Lothes et al., 2019; Sampl et al., 2017).

The present study adds to the existing literature by investigating the effectiveness of a mindfulness intervention for university students that is both brief and delivered in a digital format. Participants were recruited from a midwestern university to participate in a two-session research study. Each completed personality, mindfulness, and anxiety measures in the initial session with the expectation of a quantitative reasoning test in the next session. The second session divided participants into two groups to receive a brief digital guided meditation video or the same video with no meditation track. Following the intervention, participants received post measures of anxiety and mindfulness. mixed MANOVA and multiple regression analyses to answer specific research questions into the effectiveness of brief digital mindfulness interventions and personality traits relationship with anxiety and mindfulness

As predicted, the findings demonstrate the efficacy of a brief digital mindfulness intervention in reducing state mindfulness and state anxiety in university students. However, the results did not reveal a differential benefit for the guided meditation condition as compared to to the relaxing condition. The mindfulness intervention conditions were found to have no measured

impact on trait mindfulness, trait anxiety, or cognitive test anxiety levels. The regression models used to determine predictor variables for trait mindfulness and trait anxiety conformed to primary representations of the constructs. Specifically, the neuroticism personality trait was instrumental in predicting levels of both trait mindfulness and trait anxiety. Ancillary hierarchical regression analyses added the trait constructs in a secondary block, identifying openness and conscientious as significant predictors of trait mindfulness and trait anxiety. These findings remain consistent with traditional mindfulness intervention literature, despite the current examinations focus on brief digital mindfulness interventions (Cho et al., 2016; Hjeltnes et al., 2015; Sampl, 2017; Loathes et al., 2019).

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Chapter 1: Introduction

General anxiety disorder has been defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as excessive, difficult to control worry characterized by traits such as tension, intrusive thoughts, and obtrusive physiological reactions (American Psychiatric Association, 2013). With cognitive and physiological responses, anxiety is exacerbated by self-doubt, inadequacy perceptions, and self-blame with multiple situational specific forms (social, performance, math, and language; Sarason, 1977; Schwarzer, 1984). As early as the 1950's, the United States' educational system was considered a test-giving culture (Sarason, 1959). In short, many individuals' lives were determined by their performance on examinations at the various stages of their curricula (Aydın, 2019). These institutional pressures placed upon individuals brought about increased anxiety prevalence in university students (Gallagher, 2008). One of the more prominent variables explored within this realm of examinations of the relationships among emotional responses and academic performance is test anxiety (von der Embse et al., 2018).

In modern culture, anxiety in academic settings has been reported as a widespread and significant problem afflicting children and undergraduates, with an estimated 41% experiencing some form of anxiety (Gregor, 2005; von der Embse et al., 2018). Research examining test anxiety prevalence in age ranges from elementary schools to universities has demonstrated that the rates of individuals reporting "high" test anxiety levels vary between 15% and 22% (Ergene, 2003; Putwain & Daly, 2014). Given the high incidence rates observed in schools as well as decades of research demonstrating the negative impact of test anxiety on student performance, a vibrant domain of research has been devoted to understanding and developing interventions designed to reduce adverse outcomes from test anxiety (Ergene, 2003; von der Embse et al., 2018).

Test Anxiety

When discussing anxiety within academic settings, a litany of definitional terms has been utilized, including academic anxiety, evaluation anxiety, and test anxiety. Test anxiety is defined as phenomenological and behavioral responses associated with concern about potential negative consequences before or during an evaluative situation (Dusek, 1980; Sieber, 1980; Zeidner, 1998). The diversity of responses encompasses the broad domains of cognitive, behavioral, and physiological indicators. Test anxiety is unique from other situational-specific forms of anxiety due to the inherent focus on evaluative events and the contextual features implicitly related to the evaluation (von der Embse et al., 2018). One explanation for test anxiety development is that the individual believes their capabilities are not sufficient in meeting testing expectations – generating a perceived threat imposed by the evaluative event (Zeidner, 1998, 2007; Zeidner & Matthews, 2006). During these test anxiety-inducing situations, students exhibit maladaptive thoughts, engage in task-irrelevant behaviors (e.g., procrastination), or employ ineffective test preparation strategies, all resulting in declines in optimal performance (Dusek, 1980; von der Embse et al., 2013; Wren & Benson, 2004; Zeidner & Matthews, 2006). A leading explanation for these behavioral manifestations' instantiation is that they are preceded and triggered by the "worry" component of test anxiety (Borkovec et al., 1998; Solomon & Rothblum, 1984). In response to these failed evaluative scenarios, students are more likely to experience degraded self-efficacy, thus creating a recursive cycle (von der Embse et al., 2013). Furthermore, those with test anxiety are at risk of developing other anxiety-based disorders alongside academics' disengagement (Cho et al., 2016; Ergene, 2003; von der Embse et al., 2018).

Test Anxiety Components

Originally conceptualized as a unidimensional construct, contemporary representations of text anxiety advocate for a multidimensional framework. Multiple test anxiety models have been proposed, such as the state-trait additive test anxiety model (Zohar, 1998). Trait test anxiety represents an individual's probability of enduring anxious feelings before or during evaluative situations (Hembree, 1988). Individuals with high trait test anxiety are considered more anxious in their daily lives (Bradley et al., 2007). On the other hand, state test anxiety is a momentary context-dependent experience of anxiety influenced by heightened evaluative situations (Tempel & Neumann, 2014). The additive test anxiety model indicates individuals' test anxiety levels are determined by the summation of trait and state anxiety during threatening evaluative situations (Tempel & Neumann, 2014; Zohar, 1998).

Another multidimensional representation of test anxiety is the bifactor model, which proposes two distinct components, traditionally identified as 'worry' and 'emotionality' (Liebert & Morris, 1967; Schwarzer, 1984); with some recent research advocating for the inclusion of a social component as a third factor (Lowe et al., 2008). Prominent conceptualizations identify 'worry' and 'emotionality' components, with recent research arguing a social component as well. Worry, or cognitive test anxiety, is centered upon cognitive processes that contribute to the experience of test anxiety (Putwain & Pescod, 2017). Triggered by internal and external threatening cues, individuals are likely to experience cognitive barriers that interfere with performance (task-irrelevant cognitions, distraction; Deffenbacher, 1986; Eysenck & Calvo, 1992; Putwain, 2007; Sarason, 1977). The emotionality component, or affective test anxiety, is manifested through the awareness of anxiety-induced autonomic arousal and tension (Putwain, 2007). Environmental cues and internal insecurities brought about by the evaluation situation

trigger these reactions resulting in multiple physiological reactions (Deffenbacher et al., 1980; Putwain, 2007; Schwarzer, 1984)**.** These responses include tension, increased heart rate, dry mouth, involuntary trembling, dizziness, nausea, and increased experiences of panic (Cassady & Johnson, 2002; Putwain et al., 2015; Sarason, 1988). Emotionality is the awareness of the physiological response rather than the response itself, allowing some interpretations to suggest that the emotionality component activates the worry component (Hembree, 1988; Schwarzer, 1984). Furthermore, test anxiety's emotionality component is conceptualized as more of a "state" construct, whereas the worry components are more trait (Hembree, 1988). As mentioned, there is some recent literature promoting the inclusion of the social component of test anxiety. Conceptually, this component suggests that social systems carry proximal and distal influences on the evolution of test anxiety in individuals (Lowe et al., 2008; Segool et al., 2014). While the research has identified that social contexts determine variations in perceived test anxiety levels, the evidence has not been clear in supporting that it is a separate dimension.

Collectively, the worry component of test anxiety has been identified as the more significant factor, specifically when examining academic performance (Cassady & Johnson, 2002; Hembree, 1988; von der Embse et al., 2018). Cognitive test anxiety is more pressing than the physiological component of test anxiety because it affects individuals' ability to process information at multiple learning cycle phases (encoding, rehearsal, retrieval; Cassady, 2004; Naveh-Benjamin et al., 1987; Zeidner & Matthews, 2006).

Test Anxiety Profiles & Performance

Multiple models (interference, deficits, & attentional control) have been suggested to define how test anxiety impacts performance. Early research suggested a cognitive-interference model that proposed high-test anxious individuals' fixations with task-irrelevant cognitions

overwhelm limited information processing capacity (Liebert & Morris, 1967; Sarason, 1988; Wine, 1971). This interference (or cognitive distraction) model was followed by a skills deficit explanation that claimed high test-anxious students inefficiently encode material during test preparation leading to inefficient retrieval during the examination (Culler & Holahan, 1980; Zeidner, 1998). A more contemporary interpretation centers on the attentional control theory, which suggests that test anxiety's presence causes detrimental impairments upon the processing efficiency of the central executive, thus accounting for deficits in cognitive performance (Eysenck et al., 2007). Processing efficiency in the attentional control context (operationalized as reaction time) refers to the relationship between task accuracy and cognitive resources utilized, whereas processing effectiveness is accuracy, or performance quality on specified task (Edwards et al., 2015; Eysenck & Calvo, 1992; Miyake et al., 2000). The core assumptions to this model suggest that anxiety impairs each of the critical components within the central executive, while also undermining information processing efficiency more than performance effectiveness (Eysenck & Derakshan, 2011).

The wide variation of individuals' experiences with test anxiety has led to several explanations for how test anxiety manifests and impacts learners. This variation has also been used to argue that test anxiety is not a unitary construct universally experienced across all learners with this disposition. The most widely recognized profile system for test anxiety was compiled by Zeidner & Matthews (2006) who identified six profiles that differentiate the primary manifestations of test anxiety across individuals. While these are distinct representations of test anxiety, individuals may identify with more than one of these potentially overlapping profiles (Zeidner, 1998; Zeidner & Matthews, 2006).

Deficient Study and Test-Taking Skills

Individuals with this test anxiety profile exhibit inefficient study strategies that limit information encoding, rehearsal, and retrieval. Those experiencing these difficulties face retrieval problems during the testing phase of the learning cycle but not during the preparation phases (Naveh-Benjamin et al., 1987; Zeidner & Matthews, 2006).

Anxiety Blockage and Retrieval Problems

Test anxious students may also be characterized by anxiety-induced blockage and retrieval problems, indicating that the material is prepared efficiently, but retrieval is crippled by the presence of anxiety (Covington & Omelich, 1987; Zeidner & Matthews, 2006).

Failure-Accepting

Students characterized as failure-accepting carry low ability perceptions and accept failure with a sense of defeat (Putwain et al., 2010; Zeidner & Matthews, 2006). The construct of learned helplessness are highly related to these experiences.

Failure-Avoiding

This category of individuals achieve primarily to protect themselves from maladaptive beliefs of failure (Covington & Omelich, 1987). Characterized by effective preparation, failure-avoiding individuals will consider themselves not to have adequate ability if they fail (Elliot & McGregor, 1999; Zeidner & Matthews, 2006).

Self-Handicappers

Self-handicapping test anxious individuals reduce their effort or avoid testing to reduce expectations set by others (Harris et al., 1986). High-test anxiety individuals, being more accustomed to the anxiety experiences, use their symptoms protectively compared to low-test anxiety individuals (Smith et al., 1982).

Perfectionistic Overachievers

Individuals who are test-anxious perfectionistic overachievers are characterized by a high standard for academic success, perceptions of even higher expectations, doubt regarding the quality of performance, and a need for order and organization (Eum & Rice, 2011; Zeidner & Matthews, 2006). When these self-imposed standards are not met, individuals experience severe discontent and self-criticism (Zeidner & Matthews, 2006).

Test Anxiety Interventions

Multiple approaches have been utilized to reduce test anxiety's debilitating effects, with broad classifications of interventions encompassing cognitive, behavioral, cognitive-behavioral (Hembree, 1988). While various intervention implementations provide evidence for significant impacts on reducing test anxiety, cognitive-behavioral relaxation and attentional control therapy interventions were among the most durable across multiple meta-analyses (Ergene, 2003; Hembree, 1988; von der Embse et al., 2018). Additionally, recent meta-analyses have identified mindfulness interventions as effective in reducing test anxiety (Soares & Woods, 2020).

Mindfulness Practice

Mindfulness, originating from eastern Buddhist philosophy and practice, enables individuals to change their approach to the world while accepting a path deviating from ruminations on past and future events (Bishop et al., 2004). Broadly accepted definitions label contemporary mindfulness as a present-centered approach to everyday life via purposeful attention to the present moment (Brown & Ryan, 2003; Grossman et al., 2004; Kabat-Zinn, 1994). This present-centeredness emphasizes self-compassion, non-reactive awareness, and acceptance of self and others (Shapiro et al., 1998). Overall, remaining attentive to the present reality is the goal of a mindful state, instead of preconceived notions of what “should be” (Mesmer-Magnus et al., 2017). Evidence has demonstrated that a mindful state is attainable by

any individual using several activities, including meditation, yoga, mindful art, and rhythmic breathing (Bazzano et al., 2018; Brown & Ryan, 2003; Carsley & Heath, 2019). Inducing a mindful state is not always a conscious decision, as research has shown it can subconsciously occur (Grossman et al., 2004).

Mindfulness Construct

Similar to anxiety, mindfulness is a multidimensional construct with trait and state differences (Brown & Ryan, 2003). Trait mindfulness is a dispositional construct defined as stable individual differences in the inherent predisposition to mindfulness (Bergeron et al., 2016). The mindfulness intervention literature has converged on the representation that trait mindfulness is determined by dispositional personality trait tendencies or regular and repeated mindfulness practice (Bellinger et al., 2015). Conversely, state mindfulness – which is operationally defined as the level of mindfulness an individual experiences at a given time and place – is variable across setting and context and is influenced by situational variables (Mesmer-Magnus et al., 2017). In addition to the broad conceptualization of mindfulness, individuals can also be considered mindless. A mindless individual relies on unconscious processes and gives little effort to the present moment, proceeding through daily experiences as scripted processes or an automaton (Langer, 2000; Radel et al., 2009).

Since its popularization in the contemporary western audience over the last 30 years, many theorists have attempted to define and establish conceptualizations about the components that may define the mindfulness construct. Common components between prominent models include intentional meta-awareness, self-regulation of attention, and openness to experience. Intentional meta-awareness includes multiple characteristics for mindful individuals, such as reduced dissociations (mind-wandering), improved awareness (awareness of task-irrelevant

thoughts), and decreased rumination (focused on the present moment; Holas & Janikowski, 2013; Langer, 2000; Ritchie & Bryant, 2013). The self-regulation of attention component is embodied by a mindful individual being capable of maintaining sustained attention and attention switching (refocusing attention when wandering is detected; Bishop et al. 2004). Openness to experience denotes mindful individuals as being able to accept experiences with openness and curiosity, accepting experiences as they arise and overserving them non-judgmentally (Bishop et al., 2004; Holas & Janikowski, 2013; Langer, 1997; Ritchie & Bryant, 2012).

Mindfulness Utility

Individuals who routinely practice mindfulness-promoting activities have been documented to experience several tangential benefits, most of which contribute to an overall improvement in subjective well-being (Diener et al., 1999). This is achieved by those practicing mindfulness through skills such as decentering, which reduces emotional reactivity, leading to reductions in observed depression, anxiety, and stress (Bellinger et al., 2015; Mesmer-Magnus et al., 2017; Zoogman et al., 2015). Studies have also demonstrated improvements in academic self-regulation through mindfulness practice, attributed to reducing impulsive behavior (McCloskey, 2015). In a related line of research, attentional control (i.e., shifting, inhibition) and cognitive flexibility have been improved through routine mindfulness practices such as non-judgmental observation (Chambers et al., 2008; Lee et al., 2016; Malinowski, 2013).

Mindfulness interventions have demonstrated clinical success for a wide variety of ailments, including pain, anxiety, and stress reduction (Kabat-Zinn, 1982). Traditional intervention programs, such as Mindfulness-Based Meditation (MBM) or Mindfulness-Based Stress Reduction (MBSR), are designed to improve individual insight and awareness of the present (Kabat-Zinn, 1994, 2003). With 30 hours of instructional time over an extended period,

in addition to daily tasks, participants practice meditation, mindful movement, and awareness of daily routine (Kabat-Zinn, 1992). Mindfulness-Based Cognitive Training (MBCT) deviated from other interventions with a focus on cognitive-behavioral techniques (i.e., decentering, guided awareness) to effectively treat depressive symptoms in addition to MBSR techniques (Teasdale et al., 2000).

Mindfulness-Based Interventions

As support increased for the efficacy of traditional mindfulness interventions, researchers began examining the effectiveness of brief interventions (i.e., single session, <1 Hour). Intervention strategies include guided mindful breathing, body scan meditation, and mindful art with durations ranging from five to twenty minutes in a single session. Weger et al. (2011) utilized a 5-minute audio intervention teaching present-centered awareness that reduced stereotype threat perceptions and improved mindfulness compared to a control. Daniel (2014) similarly observed increases in academic performance after reducing stereotype threat perceptions post breathing meditation. Kiken and Shook (2011) found significant reductions in negativity bias via a 15-minute mindful breathing exercise. Additional brief intervention studies uncovered similar results, improving mindfulness in participants while improving upon variables of interest such as mind-wandering and recall (Alberts & Thewissen, 2011; Bonamo et al., 2015; Mrazek et al., 2012).

With the growing prevalence of smartphone-based mindfulness solutions, digital mindfulness intervention literature has shown similar effectiveness in improving state mindfulness. Lothes et al. (2019) compared traditional and digital delivery methods for a DBT mindfulness training program. The findings indicated that there are non-significant differences between delivery methods in reducing test anxiety and the improvement of state mindfulness.

Comparisons of brief mindfulness intervention delivery revealed that state mindfulness is significantly impacted by a digital 5-minute body scan meditation, whereas an in-person intervention revealed non-significant differences (Mahmood et al., 2016).

A growing line of intervention research has begun to explore the positive effects mindfulness practices have on anxiety perceptions before and during evaluative situations. Utilizing MBSR variants or mindful breathing interventions, previous examinations into test anxiety ranged between one week and two months in duration. A consistent finding among the literature reveals significantly reduced test anxiety alongside mindfulness improvements. (Cho et al., 2016; Hjeltnes et al., 2015; Lothes et al., 2019; Sampl et al., 2017).

Purpose of the Study

The purpose of this study aims to expand upon previous research by examining the efficacy of brief digital mindfulness interventions in decreasing anxiety and improving mindfulness. This study's findings are anticipated to expand upon the current availability of literature examining mindfulness interventions effective in reducing test anxiety in undergraduate students. Specifically, this study will investigate the following research questions and hypotheses:

RQ1: Do brief digital mindfulness interventions influence student anxiety and mindfulness?

H1a: Individuals who engage in the guided meditation intervention will experience significantly improved state mindfulness, as compared to participants in the relaxing condition.

H1b: Individuals who engage in the guided meditation intervention will experience significantly improved state anxiety, as compared to participants in the relaxing condition.

H1c: Individuals who engage in the guided meditation intervention will experience significantly improved test anxiety, as compared to participants in the relaxing condition.

H2a: Individuals will not experience significant changes in trait anxiety, regardless of group assignment.

H2b: Individuals will not experience significant changes in trait mindfulness regardless of group assignment.

RQ2: Do personality traits predict mindfulness and student anxiety?

H3a: The openness personality trait will significantly predict trait mindfulness.

H3b: The neuroticism personality trait will significantly predict trait anxiety.

Chapter 2: Review of the Literature

Test Anxiety

Test Anxiety Conceptualizations

Over the years, test anxiety has taken on many prominent definitions. Beginning with Spielberger (1972), test anxiety was broadly defined as an "unpleasant state characterized by feelings of tension and apprehension, worrisome thoughts, and the activations of the autonomic nervous system when an individual faces evaluative achievement-demanding situations." Contemporary test anxiety research utilizes this definition in addition to the more recently offered by Zeidner (1998) defined as, "the set of phenomenological, and behavioral responses that accompany concern about a possible negative consequence or failure on an exam or similar evaluative situation." Zeidner further defined test anxiety as stress synonymous with intrinsic fear and worry about negative evaluations resulting in responses ranging from behavioral, physiological, and emotional varieties (Zeidner, 1998).

Estimated prevalence rates of anxiety problems range from 10% to 40% (Gregor, 2005; von der Embse et al., 2018). In elementary & secondary classrooms, this value varies between 15% and 22% for "high" test anxiety (Putwain & Daly, 2014). Likewise, an estimated 15-20% of university students experience significant test anxiety (Ergene, 2003).

Test anxiety originates as maladaptive self-beliefs (i.e., poor attributions, self-critical thoughts, avoidance), thus resulting in increased threat perception, inward attentional focus, and emotion-focused coping (Putwain & Pescod, 2017). Previous research has differentiated test anxiety from other situational specific forms of anxiety through the focus on evaluative situations (von der Embse et al., 2018). Typically being invoked in educational settings, test anxiety indicates that students believe that their social, motivational, and intellectual capabilities

cannot meet predesigned expectations with the testing situations (Zeidner, 2007). These behavioral and emotional responses to test anxious moments can be exacerbated by ruminating or worry-based metacognitive beliefs in response to threats (Putwain & Pescod, 2017).

According to Lowe et al. (2008), test anxiety can begin in two ways: a direct appraisal of test-item performance or the final results on an examination. In essence, test anxiety research indicates that anxiety levels are directly linked to ability, with test anxiety increasing as ability/skill level decreases (Levine, 2008). Hembree's (1988) meta-analysis pulled this apart further by stating that low-ability students have higher test anxiety rates than average students, who, in turn, report high rates of test anxiety compared to those classified as high ability. One potential explanation for this relationship between test anxiety and ability is that the test anxiety itself is interfering with performance, thus making individuals appear to possess a low ability level (Levine, 2008). Individuals who are identified as test anxious process their environment distinctively different from their counterparts in that their anxiety reactions are related to how they and others evaluate their performance (Sarason, 1988).

During test anxiety triggered events, students exhibit intrusive thoughts, feelings, and inclination toward off-task behaviors. The introduction of these maladaptive influences negatively influences the individuals, leading to a decline in task performance. As a result, students respond with inhibited self-efficacy, self-deprecating cognitions, and expectations of failure attributions in future evaluative settings (Ergene, 2003). The decline due to maladaptive interference reinforces the intrusive thoughts, thus increasing test anxiety through a recursive downward cycle (von der Embse et al., 2013).

Left unchecked, test anxious individuals are at risk for declining academic performance and the development of additional anxiety disorders (Cho et al., 2016). These test anxious

individuals reveal this impaired performance due to preoccupation with intrusive thoughts of failure before or during the evaluation (Cho et al., 2016). Related to the experiences of test anxiety, individuals are at higher risk of additionally experiencing depression, degraded test performance, and a lack of engagement with course content (von der Embse et al., 2018). The variability associated with test anxiety manifestation aligns with individual variability in biological, psychological, and environmental variables.

Test Anxiety Manifestations

While it has limited representation within the literature, authors have suggested that test anxiety may also have behavioral expressions in students (Dusek, 1980; Sieber, 1980; Zeidner, 1998). According to Zeidner (1998), these overt behaviors present in two distinct manners: deficient study and test-taking skills and procrastination/avoidant behaviors. Deficient study and test-taking skills are characterized by high test anxious students experiencing significant behavioral impediments in academic skills (Zeidner, 1998). Examples of these deficient skills include time utilization, note-taking, subject integration, and exam management (Culler & Holahan, 1980; Kirkland & Hollandsworth Jr., 1980). These collective skills inhibit high anxiety students' ability in the initial learning phase and, more significantly, the retrieval phase thus impacting test performances (Zeidner, 1998).

Behavioral manifestations are represented through avoidant or procrastination behaviors as well. Procrastination, the excessive delay of studying material, can be present in individuals in two separate ways (Zeidner, 1998). According to research, a prominent factor encouraging procrastination behavior is disengagement out of fear of failure (Solomon & Rothblum, 1984). Another significant factor attributed to procrastination is the aversive perception of the material (Solomon & Rothblum, 1984). Avoidant behavior representations also include individuals

conducting off-task, or task-irrelevant, behaviors (Lowe et al., 2008; von der Embse et al., 2018; Zeidner, 1998). Including fidgeting, object manipulation, inattentiveness, and other nervous/distracting behaviors, task-irrelevant behaviors are attended to by high test anxious students compared to low test anxious students (Dusek, 1980; Wren & Benson, 2004).

While various models of test anxiety suggest that the behavioral symptoms enhance the expressions of test anxiety in addition to the other components (Lowe et al., 2008), other research suggests the avoidant behaviors and detrimental study habits may originate from the worry component of test anxiety (Borkovec et al., 1998). In essence, the worry component of test anxiety precedes behavioral outcomes because individuals will generate catastrophic imagery of the testing situations and, in response, participate in the aforementioned behavioral characteristics (Borkovec et al., 1998).

Trait & State Test Anxiety

Before Spielberger (1972), test anxiety had been believed only to be a unidimensional construct. Nevertheless, with advances in research perspectives, Spielberger uncovered distinguishing elements to the test anxiety construct: State and Trait. Trait test anxiety is understood to represent an individual's proneness to experiencing anxious feelings when preparing for or during evaluative situations (Hembree, 1988). In general, those with high levels of trait test anxiety are generally more anxious in their day-to-day lives, including situationally specific areas such as high-stakes testing (Bradley et al., 2007). Those students reporting higher levels of trait test anxiety identify challenges as threatening due to their internal perceptions and threat appraisals (Bradley et al., 2007). The heightened perceptions of challenges as threats, in turn, activate autonomic stress reactions and worry responses leading to interference with cognitive processes (Bradley et al., 2007).

Conversely, state anxiety is understood to be a transitory emotional state that activates in heightened evaluative situations (Tempel & Neumann, 2014).These situations can include public speaking, test-taking, or even performing athletically during a competition. Also, students who perceive their skills as inadequate for a particular examination situation will be more prone to a state test anxious experience. Therefore, even if individuals have a heightened state test anxiety moment due to a specified event, they may not exhibit elevated trait anxiety.

According to research, these components of test anxiety are understood to be intertwined. Therefore, the more naturally test anxious an individual is (trait), the more intense the individual will experience test anxious conditions when confronted with possible anxiety-inducing moments (Spielberger et al., 1971; Tempel & Neumann, 2014). Test anxiety has been identified as a primary trait anxiety component (Cassady & Johnson, 2002)

Test Anxiety Components

Throughout the test anxiety literature, there are multiple conceptions about the structure that embodies the multidimensional construct. The most widely accepted test anxiety conceptualization includes the components labeled 'Worry' and 'Emotionality'. Overall, the Worry component refers to the cognitive basis for test anxiety, whereas the emotionality component references the physiological reactions to stressors that are manifestations of anxiety.

Worry

The cognitive component of test anxiety, worry, centers on an individual’s cognitions related to examination outcomes, the consequences of poor performance, and task-irrelevant thoughts (Putwain et al., 2015; Putwain & Pescod, 2017). One mechanism through which these cognitive concerns arise is when the individual compares their ability to others (Liebert & Morris, 1967). As a result, the maladaptive thoughts, distractions, or rumination interfere with

performance on complex tasks instead of the individual being focused on task-oriented action (Sarason, 1977). The concerns that arise may also reflect concern about accurately perceived past/present performance difficulties (Morris et al., 1981). The strength of the worry response during evaluative situations is the functions of an individual's accumulated experience and environmental variables (Zeidner, 1998). Furthermore, high anxious individuals are more likely to experience self-critical thought processes leading to derogatory interference that impacts performance.

The overall experience of worry is activated by situational influences that impact inter-individual evaluative processes (Morris et al., 1981). Test anxious thoughts are triggered by internal and external cues when an individual's self-esteem is threatened via a focus on performance, and potential failure (Deffenbacher, 1986; Putwain, 2007) Whereas other constructs of test anxiety may be more static, worry changes as individual cognitively reappraises the situation as it draws closer (Deffenbacher, 1980). Cognitive reappraisal is conducted by highly anxious individuals whenever conditions related to the evaluative situation impact the possibility of failure (Deffenbacher, 1980). The reassessment of worry-inducing triggers results in high test anxious students experiencing fluid levels of cognitive test anxiety before, during, and after the threatening tasks have occurred (Cassady & Johnson, 2002).

When compared to other potential components of test anxiety, the cognitive component is frequently identified as the more significant factor when examining academic performance (Cassady & Johnson, 2002; Hembree, 1988; von der Embse et al., 2018). In line with these findings, the worry component of test anxiety is also negatively correlated with problem-focused coping strategies such as planning ahead and suppression of irrelevant thoughts. (Stöber & Pekrun, 2004). These findings suggest that individuals with higher cognitive test anxiety have a

higher probability of experiencing mind wandering and reduced attentional capabilities (Deffenbacher, 1986).

According to literature, the worry component of test anxiety may take on multiple functions for test anxious individuals, with some indications that there can be both facilitative and debilitative outcomes. The problem-solving function, a preparation based function, encourages individuals to anticipate multiple adverse outcomes (Borkovec et al., 1983). As a result, individuals are potentially better equipped with effective coping strategies to increase tolerance and reduce their anxiety experiences (Zeidner, 1998). The motivational function can potentially serve as an approach or avoidance element for individuals. When approach-oriented goals are established, proactive outcomes through motivation enable adaptive strategies that promote an effort to maximize performance (Zeidner, 1998). Conversely, adopting avoidant behaviors to reduce anxiety induces maladaptive strategies such as procrastination (Borkovec et al., 1983; Zeidner, 1998). The mastery control function suggests that individuals will overanalyze and overthink situations to prepare for every possible outcome in a misguided attempt to maintain control over their environment (Zeidner, 1998).

Emotionality

As the affective physiological component of test anxiety, the perceptions of anxiety-induced autonomic arousal are triggered by environmental cues and internal insecurities brought about by the evaluation situation itself (Deffenbacher et al., 1980; Putwain, 2007; Schwarzer, 1984). Contemporary test anxiety researchers have also referred to the emotionality component of test anxiety as affective test anxiety or physiological hyperarousal (Lowe et al., 2008; Zeidner, 2007). The emotionality component of test anxiety peaks when an individual feels the least confident in their abilities before an examination (Liebert & Morris, 1967).

Individuals experience multiple physiological markers of anxiety. These responses include tension, increased heart rate, dry mouth, involuntary trembling, dizziness, nausea, and increased experiences of panic (Cassady & Johnson, 2002; Putwain et al., 2015; Sarason, 1988). In addition to the influences of the autonomic nervous system, cortisol is related to test anxious reactions (Bradley et al., 2007; Conneely & Hughes, 2010).

A critical feature of emotionality is that while an individual may be experiencing these responses, emotionality is the awareness that the responses are occurring instead of the actual response itself (Schwarzer, 1984). Therefore, Hembree (1988) suggested that the emotionality component of test anxiety experience triggers the worry component. In this interpretation, the worry component of test anxiety is activated after an individual perceives the elevated amounts of physiological arousal (Deffenbacher et al., 1980).

Another vital distinction needs to be made when highlighting the emotionality dimension of test anxiety; high emotionality is only highly correlated with declines in test performance when the individual is experiencing detriments from the worry component of test anxiety as well (Schwarzer, 1984). Previous research reveals that this relationship between Worry and Emotionality and declining performance indicates that the worry dimension of test anxiety is a primary indicator of performance (Deffenbacher et al., 1980; Morris et al., 1981; Schwarzer, 1984). Additionally, emotionality is related to other measured constructs as well. For instance, the emotionality component of test anxiety strongly correlates to task orientation, social support, avoidance behaviors, lack of confidence, and task preparation (Stöber, 2004).

Social Component

In addition to the standard two-factor model (worry, emotionality), limited research has also suggested a third component focused on the social domain of test anxiety (Lowe et al.,

2008). The biopsychosocial model emphasizes the impact social systems carry both proximally and distally on the evolution of test anxiety in individuals (Lowe et al., 2008; Segool et al., 2014). Social humiliation, or social derogation, refers to the cognitions individuals will experience that are related to concerns that an individual will receive unfavorable test comparison from others, or others will ridicule one's examination performance (Lowe et al., 2008; Segool et al., 2014; Whitaker Sena et al., 2007). Multiple variables (i.e., social-emotional functioning, study skills, ability, and self-efficacy) play a role in the perceptions of threat for evaluative situations (Lowe et al., 2008). For students who are impacted by the proposed social component, the diminishment of the social image becomes a significant distraction (Friedman & Bendas-Jacob, 1997). As a result, damage to individuals' social statuses is perceived as an immediate threat, thus elevating the anxious response (Friedman & Bendas-Jacob, 1997). These social influences carry the potential to develop into socially prescribed perfectionism or the belief that others maintain an unrealistic or exaggerated performance that is difficult or impossible to maintain (Zeidner, 1998). Individuals with this type of perfectionism believe they must meet unattainable standards to gain or maintain their social acceptance from relevant others (Zeidner, 1998).

Test Anxiety Models

While the test anxiety components are relevant to understanding the difficulties individuals may have with evaluative situations, prevailing test anxiety research focuses on the debilitative impacts on academic performance. Generally speaking, debilitative impacts on performance are the result of excessive cognitive test anxiety. The underlying explanations for how test anxiety impacts performance can generally be summarized with three different non-

mutually exclusive models: cognitive interference model, skill deficits model, and attentional control theory.

Cognitive Interference Model

Multiple models have been posited attempting to interpret how an individual's attention and cognitive capacity are differentially influenced in the face of examination situations. Early theorists presented a cognitive-interference model (Liebert & Morris, 1967; Sarason, 1988; Wine, 1971). The interference approach to understanding test anxiety posits that high-test anxious individuals' preoccupations with task-irrelevant cognitions occupy limited information processing capacity. Task-irrelevant cognitions are the self-devaluing ruminations that occur during stressful situations. These detrimental cognitive processes are not restricted to testing situations, as individuals experience disruptive cognitive patterns during test preparation as well (Cassady, 2004).

Skill Deficit Model

Following the introduction of the interference conceptualization of test anxiety, researchers proposed a study-skill deficit model of test anxiety (Culler & Holahan, 1980). The base-level deficits approach suggested that test anxious students inadequately encode information during preparation phases leading to inefficient retrieval at the time of the examination (Zeidner, 1998). Other conceptualizations of this approach suggest that an individual's low ability directly impacts the effectiveness of study skills and, therefore, the input and organization of content (Covington & Omelich, 1987).

Naveh-Benjamin et al. (1987) conducted a series of studies designed to evaluate if the poor evaluative performance of high test-anxious students is due to poor organizational processes in multiple phases of the learning cycle. The first study included 86 undergraduate students

(Sophomores & Juniors) enrolled in a research methodology course at the Ben-Gurion University of the Negev. Using the Liebert-Morris Worry-Emotionality Scale, participants were divided at the 70th percentile to indicate high (n=26; m = 3.40) and low-test-anxiety groups (n=46; med. = 1.95). Both groups were instructed to complete an adapted cognitive-structure task, a technique that directly measures how students organize concepts of materials. The output produces an ordered tree for each participant that was compared to the instructor's tree revealing a moderate correlation between that and students' final examination grades. Furthermore, the findings of the first study t-tests between the test anxiety groups showed that high test anxious students had significantly weaker concept organization and course performance compared to lower test-anxious individuals.

The second study in this series sought to replicate the first study with a new population while additionally examining if there are multiple varieties of test-anxious students (Naveh-Benjamin et al., 1987). Using 84 freshmen students from an introductory psychology course at the University of Michigan, the Worry portion of the Liebert-Morris scale and the Learning and Study Strategies Inventory (LASSI) divided students into high- and low-test-anxiety groups as well as high- and low-study-habits. The results replicated the previous study showing that high-test-anxious students perform worse with concept organization than less anxious students. Additionally, this study showed that high test-anxious individuals could be separated into groups based on their study habits. Those with good study habits and high-test anxiety are suggested to have retrieval problems during evaluative situations. This is compared to individuals with poor study skills and high-test anxiety who have difficulties encoding and storing information in the pre-test phase of the learning cycle and during the retrieval phase as well.

Attentional Control Theory

While both models adequately define the complex processes of test anxiety's influence on performance, contemporary research provides more nuanced explanations about the dynamic nature of test anxiety. Attentional control theory, an extension of processing efficiency theory (Eysenck & Calvo, 1992), suggests that the presence of anxiety causes detrimental impairments upon individuals' processing efficiency of the central executive (Eysenck et al., 2007).

The central executive is an attention-based system that contains limited capacity and is responsible for planning, decision making, and troubleshooting (Eysenck & Calvo, 1992). Operating within individuals working memory, the central executive and its collective of executive functions are impacted by threat perceptions due to heightened anxiety (Eysenck & Derakshan, 2011). Aligned with Baddeley's working memory model, attentional control theory focuses on the interaction between executive functions and the presence of anxiety to account for deficits in cognitive performance.

In line with neurological research posited by Miyake & Friedman (2012), the central executive commands a group of united and diverse executive functions: updating, inhibition, and shifting. The updating function is responsible for the monitoring and updating of currently stored information within the working memory, a task which is critical to short-term memory function (Eysenck & Derakshan, 2011; Miyake & Friedman, 2012). Derakshan & Eysenck (2009) consider the updating function as a measure of short-term memory or attentional capacity. The inhibition function of the central executive is responsible for preventing derailed performance by overriding task-irrelevant responses and stimuli (Eysenck & Derakshan, 2011; Miyake & Friedman, 2012). The influence of inhibition is seen during experimental tasks that prey upon automatic/dominant responses. During inhibition tasks, brain activation decreases due to negative activation, indicating that it may be a deliberate suppression instead of a passive

reaction (Miyake et al., 2000). The final executive function, shifting, is responsible for allowing individuals to transfer attention smoothly between task-relevant stimuli (Eysenck & Derakshan, 2011; Miyake & Friedman, 2012). Shifting is the positive attentional control measure, which allows for the disengagement from non-relevant stimuli to the task-relevant target stimuli (Eysenck & Derakshan, 2011; Miyake et al., 2000).

The precursor framework to the attentional control theory is the conceptual distinction between processing efficiency and performance effectiveness. Performance effectiveness is the quality of task performance, while processing efficiency is the relationship between performance effectiveness and the amount of effort expended (Eysenck & Derakshan, 2011). Optimally, individuals want high-performance effectiveness and low resource utilization as it leads to high processing efficiency (Derakshan & Eysenck, 2009; Eysenck & Derakshan, 2011). In research scenarios, performance effectiveness is the quality of the task, which in most cases, equates to accuracy on the specified function.

These elements, anxiety, executive functions, and performance effectiveness together drive the attentional control theory. Four base hypotheses frame the structure of the attentional control theory:

1. The central executive is functionally impaired by anxiety.
2. The inhibition function is impaired by anxiety.
3. The shifting function is impaired by anxiety.
4. There is a distinction between processing efficiency and performance effectiveness, and anxiety undermines processing efficiency more than performance effectiveness (Eysenck & Derakshan, 2011).

Various research findings highlight the adverse effects anxiety poses upon the overall central executive and the associated functions individually. The primary hypothesis indicates that the central executive is affected during the presence of anxiety (Eysenck & Derakshan, 2011).

Eysenck et al. (2005) measured the effect of differing levels of anxiety on individuals working memory. The findings revealed that under situations of high trait anxiety during a dual-task experiment, only tasks that isolated the central executive were impacted. The results from this experiment support the hypothesis stating that increased anxiety will impair the functioning of the central executive. The research into this hypothesis agrees that individuals with more considerable amounts of anxiety are more susceptible to distractors than their low-anxiety counterparts (Pacheo-Ungietti, Acota, Callejas, & Lupianez, 2010). The shifting function, responsible for diverting away from distractors and staying on task-relevant stimuli, is also impacted by individuals who experience high rates of anxiety. Measuring this is completed by performing a task-switching experiment where the control group completes all of tasks A and B, but the experimental group does A and B interspersed (Eysenck & Derakshan, 2011; Miyake et al., 2000). Individuals who commit more errors during the experimental task than the control task shows the assessment of the shifting function. The distinction between performance effectiveness and processing efficiency and the effect of anxiety on processing efficiency has been seen through imaging studies. As seen under fMRI and ERPs, individuals who experience heightened anxiety show increased brain activity and expend more effort toward their task, which has been attributed to the effect of anxiety upon performance efficiency (Fales et al., 2008).

Zeidner's Test Anxiety Profiles

Another way to represent how test anxiety occurs/differs was proposed by Zeidner (1998). According to Zeidner and Matthews (2006), the test anxiety construct potentially presents non-uniformly between individuals. Overall, this approach posits that individuals' unique characteristics may differentiate the experience and treatment of test anxiety.

Deficient Study and Test-Taking Skills

There is a difference in study and examination taking skills based on the level of anxiety an individual possesses (Naveh-Benjamin et al., 1981). Those with high test anxiety are profiled to exhibit detrimental information processing skill deficits, including encoding capabilities, rehearsal abilities, and information retrieval. Each of these skill deficits is related to different phases of the learning cycle. Encoding and rehearsal are linked to necessary study skills before examinations, while retrieval is directly related to the application of knowledge during a test (Zeidner, 1998). Individuals with heightened test anxiety tend to exhibit academic difficulties before and during examinations due to their inefficient strategies and processing detriments (Paulman & Kennelly, 1984). Naveh-Benjamin's (1987) series of studies highlight this test anxiety profile by conducting research indicating that high-test anxiety is suggested to have retrieval problems during evaluative situations, yet not in any other phases of the learning cycle.

Anxiety Blockage and Retrieval Problems

Test anxious individuals may also be described as having anxiety induced blockage and retrieval. Students struggling with this manifestation of test anxiety can efficiently encode information during the "pre" phases of examination preparation, yet during the actual examination, individuals struggle with the stresses and pressures of evaluative situations (Zeidner, 1998; Zeidner & Matthews, 2006). These struggles present as concentration and information retrieval difficulties due to anxious arousal during examinations (Naveh-Benjamin et al., 1987; Zeidner, 1998).

Covington and Omelich (1987) investigated test anxiety's influence on knowledge retrieval via blocking previously learned responses. The study included 189 undergraduates from an introductory psychology course at the University of California, Berkeley (51% Male, 54%

Sophomores). Participants were given a 12-item vocabulary test twice on back-to-back days, once in an evaluative and again in a nonevaluative situation. The test was comprised of equal numbers of easy or hard items, confirmed by students' ratings of item difficulty. Additionally, participants received three individual differences measures for anxiety (Reactions to Test; RTT), ability (Lorge-Thorndike Vocabulary Test; L-T), and study effectiveness (developed for study). These were used to create separate high-low group differentiation for each measure, with the split for each group happening at the median split.

Using these parameters, the researchers found that on a retest, there was no significant change in performance on "hard" items. However, there was a significant change in performance observed for those in the high anxiety - effective study group from the initial evaluation to the nonevaluative retest (Covington & Omelich, 1987). These results suggest that information considered "easy" was interfered with due to the high anxiety on the initial test, which caused a blockage of knowledge retrieval of studied information.

Failure-Accepting

Another category of test anxious individuals is those who accept their failure due to their perceptions of low-ability and low-success academically. These perceptions are created via a history of repeated examination failure, using low ability to explain their shortcomings (Covington & Omelich, 1985; Wigfield & Eccles, 1989). Individuals in this category accept their failures resulting in apathy, resignation, and a sense of defeat (Zeidner & Matthews, 2006). These experiences are highly related to the construct of learned helplessness.

Putwain et al. (2010) designed a study with the intention of further understanding the relationship between test anxiety and the constructs of achievement goals and competence beliefs. The study included 175 students (115 females; mean age = 17) enrolled in a sixth-form

college (post-compulsory education between school and university in the UK). Utilizing six self-report instruments (Achievement Goals Questionnaire, Patterns of Adaptive Learning Scales, Study Management and Academic Results Test, Academic Self-Description Questionnaire II, Revised Test Anxiety Scale, & Inventory of Parental Influence), bivariate correlations, hierarchical regressions, and mediation models were conducted. The relevant results from this analysis revealed that an individual's academic self-concept and test competence significantly negatively predicted the cognitive component of test anxiety. These results support the assertion that individuals with degraded perceptions of academic self-confidence will experience more significant cognitive test anxiety.

Failure-Avoiding

Test anxious students within this category are driven to achieve primarily as a means to protect themselves from beliefs that they lack the ability and the implications of failure (Covington & Omelich, 1987). Individuals within this subgroup are characterized by high preparation and effective study strategies, yet if they still fail, they will consider themselves not to have adequate ability, thus inducing anxious reactions before and during future examinations (Zeidner & Matthews, 2006).

Elliot & McGregor (1999) designed a pair of studies to unveil how the test anxiety construct acts as a mediator for approach and avoidance achievement motivation orientations and exam performance. The initial study focused solely on state test anxiety as a mediator between achievement goals and performance outcomes. The researchers utilized measures of achievement goals, state test anxiety, and a worry emotionality questionnaire with 150 undergraduate students (82 Females) in an introductory psychology course at the University of Rochester. Information was collected from individuals for five weeks leading up to an exam. A significant negative

direct relationship between performance-avoiding achievement goals and academic performance was reported. Additionally, significant mediators of state test anxiety and worry were reported between performance-avoidance goals and academic performance. Together, these results indicate that individuals who carry performance-avoidant goals are prone to high levels of test anxiety during exams.

The second study is a broader approach to the initial study examining both state and trait test anxiety in the context of the relationship between achievement goals and exam performance. Additionally, this study sought to converge the constructs of fear of failure and test anxiety. Using 172 (107 Females) introductory psychology students at the University of Rochester, researchers collected the same information as the initial study with the addition of a fear of failure self-report measure. Once again, performance-avoidance achievement goals were directly related to examination performance mediated by state test anxiety and worry. The convergence between the fear of failure and trait test anxiety constructs was conducted using factor analyses and mediational analyses. Factor analyses showed both measures loaded on the same factor yielding 86% of the variance. Both constructs significantly predicted performance-avoidance goals in regression analyses providing evidence that both constructs are analogous.

Self-Handicappers

Characterized by reducing effort or avoiding testing situations, self-handicapping individuals use anxious reactions as an excuse to escape responsibility, thus reducing expectations others hold for themselves (Zeidner & Matthews, 2006). High-test anxiety individuals, being more accustomed to the anxiety experiences, use their symptoms protectively compared to low-test anxiety individuals (Smith et al., 1982).

Harris et al. (1986) researched to determine if high test anxiety would predict attributions of self-handicapping behavior. Participants were 104 randomly selected undergraduate females (ages 17-34; M = 19.18) from the University of Kansas. Those selected to participate completed multiple assessments, including State-Trait Anxiety Inventory, Covert Self-Esteem Scale, Fear-of-Failure Scale, Multiple Affect Adjective Checklist, & a questionnaire designed to assess self-handicapping. Participants were divided into two balanced groups based upon the reported level of test anxiety, among other included variables. The objective for participants was to complete a two-part intelligence examination. Half of the participants completed the intelligence test under the belief that it was a high-evaluative stress condition, while the remaining participants believed it was a pilot testing for the intelligence test. The results from multiple regression analyses predicted that test anxiety in individuals significantly predicts the level of effort, self-handicapping behavior, & self-esteem. These results support notions that individuals who are high in test anxiety will utilize self-handicapping behaviors to protect their self-esteem.

Perfectionist Overachievers

Individuals classified as high-test anxious, perfectionistic overachievers are characterized by a high individual standard for academic success, perceptions of even higher expectations, doubt regarding the quality of performance, and a need for order and organization (Zeidner & Matthews, 2006). No amount of effort is enough, aside from perfection, as the individual strives for recognition. When an individual fails to meet self-imposed standards, they experience severe discontent and self-critical analysis. The expectation of perfection then heightens the individual's experience of anxiety during evaluative situations (Zeidner & Matthews, 2006).

Eum & Rice (2011) aimed to explain the relationship between cognitive test anxiety, perfectionism, goal orientations, and academic performance. The study hosted 134

undergraduate students [62% Female; 18-23 years (M=19.08)] in a large southern university. A word list recall task was designed to induce test anxiety in participants and measure academic performance alongside GPA. The Cognitive Test Anxiety Scale, Almost Perfect Scale-Revised, and Achievement Goal Questionnaire were used to measure the constructs of test anxiety, perfectionism, and achievement goals, respectively. Correlations and hierarchical multiple regression statistical analyses were used to determine relationships between constructs for this data. Correlation analyses showed strong significant positive relationships between cognitive test anxiety and the constructs of maladaptive perfectionism, performance-avoidance, and academic performance. The hierarchical multiple regression results reveal that 50% of the variance in cognitive test anxiety was significantly predicted by maladaptive perfectionism and performance-avoidance goal orientations. Overall, the results indicate that individuals test anxious responses that may present because of high academic performance expectations and the potential disparity between expected and actual outcomes.

Test Anxiety Interventions

Multiple interventions and treatments have been studied to understand how test anxiety can be influenced to reduce its potentially debilitating effects. Multiple meta-analyses have been conducted to assess the effectiveness of the variety of interventions as the measurement and understanding of test anxiety construct has evolved.

Hembree's (1988) seminal meta-analysis collected 562 total studies between 1950 & 1986. Of these, 137 examined the effects of treating test anxiety. The measured treatments were separated into classes by the focus of the interventions. There were behavioral and cognitive interventions that influenced the emotionality and worry components of test anxiety, respectively. Also, there were treatment designs that addressed both emotionality and worry test

anxiety components concurrently. Two final classes of interventions were study skills and test-wiseness training interventions. These interventions are directed at improving an individual's ability to study and academic test-taking skills.

Behavioral intervention examples include systematic desensitization, relaxation training, modeling, positive reinforcement, extinction, and hypnosis. Meta-analysis results revealed that all interventions were effective in decreasing test anxiety, but relaxation training and systematic desensitization were most notable in reducing test anxiety. Furthermore, each of the behavioral intervention types was found to be significantly effective in improving participant's test performance. The cognitive intervention, group counseling, did not appear to be effective in reducing test anxiety. Additionally, it was not effective in improving test performance. Cognitive-behavioral treatments, such as cognitive modification, attentional control training, insight therapy, and stress inoculation, resulted in significant changes in test anxiety. Additionally, these interventions were consistently seen to improve test performance and GPA (Hembree, 1988).

Study skills interventions assessed within the Hembree meta-analysis were not explicitly defined, regardless the results demonstrated that specific interventions designed to support study skills training were not effective in reducing test anxiety. When study skills were paired with other interventions, the test anxiety reduction was mostly unchanged, indicating that those interventions are not effective in reducing test anxiety. However, test wiseness treatments yielded moderate reductions in test anxiety. Both types of interventions did not result in significant changes to test performance or GPA.

Ergene (2003) conducted a later meta-analysis intending to determine the effectiveness of test anxiety reduction programs. Literature collection identified 56 studies met inclusion criteria,

with publication dates between 1973-1998. Similar to Hembree's meta-analysis, intervention approaches were divided into separate groups: Behavioral, Cognitive, Cognitive-Behavioral, Skill-focused, and blending between the techniques mentioned earlier. The results indicated that there were significant differences between the approaches. Consistent with Hembree (1988), the behavioral (i.e., systematic desensitization) and cognitive (i.e., Relaxation therapy) approach significantly decrease test anxiety. Additionally, skill-focused training had small effects, but when paired with cognitive-based interventions, the effectiveness increases.

Von der Embse et al. (2013) completed a systematic literature review of test anxiety interventions for school-aged youth between 2000-2010. After exclusion criteria were met, ten articles met the parameters of the review. Each of the studies included an intervention with a control group included in the design. Additionally, one study included elementary students while the rest were high school-aged. In line with previous meta-analyses, interventions were aligned with techniques grounded in behavioral, cognitive, cognitive-behavioral, study skills, or test-taking skills. Each of these approaches yielded significant results in reducing test anxiety and improving academic task performance; prominent results were observed with CBT-relaxation techniques in multiple studies across the age groups.

Von der Embse et al. (2017) expanded upon the literature review with a full-fledged test anxiety meta-analysis, continuing from where Hembree (1988) left off. Utilizing 238 studies published between 1988 to 2017, this meta-analysis synthesized results to highlight predictors, correlates, and relationships with test anxiety. First, the analysis examined how test anxiety and its subcomponents correlated with standard educational performance measures: classroom tests, GPA, and standardized tests, each significantly correlated to the overall test anxiety construct. When examining the subcomponents of test anxiety, all correlations were significant but stronger

relationships were reported with the cognitive (worry) component. Additionally, the social component of test anxiety was significantly related to performance outcomes, while the behavioral component was not.

The meta-analysis also examined how test anxiety related to other constructs. Notably, significant inverse relationships were identified between coping strategies, suggesting that high test anxious students are more likely to utilize avoidant coping strategies (task-irrelevant behaviors). Also, relationships between "Big Five" personality traits were assessed revealing that significant positive relationships were reported with neuroticism (i.e., vulnerable to stressors in the environment) and negative relationships with conscientiousness (i.e., self-disciplined), openness (i.e., insightful, curious), extraversion (i.e., assertive, positive), and agreeableness (i.e., trusting, empathetic). Other results highlighted significant negative relationships between self-concept, intrinsic motivation, and self-regulation.

Soares & Woods (2020) conducted a literature review of test anxiety interventions between 2011-2018. The parameters for inclusion criteria identified 11 studies as being eligible for this review. The contained interventions expanded beyond the cognitive-behavioral techniques included in Ergene (2003) & Hembree (1988), introducing mindfulness activities, performance activities, and stress reduction techniques to reducing test anxiety. Relevant findings indicated that all interventions reported at least mixed results for impacting the experience of test anxiety. Two studies (Carsley & Heath, 2018) focused on brief mindfulness interventions (mandala coloring task) and revealed significant decreases in test anxiety between pre-post measures.

Mindfulness

Introduction

A potential method for reducing general anxiety and impacting other related constructs is through mindfulness practices. Mindfulness, with roots originating in Buddhist practice and philosophy, instructs meditators to change how they approach the world around them while accepting a path leading to the interruption of personal ruminations on previous and future events (Bishop et al., 2004). Generally defined, mindfulness guides individuals to adopt a present-centered approach to everyday life via purposeful attention to the present moment (Brown & Ryan, 2003; Grossman et al., 2004; Kabat-Zinn, 1994).

The purposeful attention in this present-centered approach needs to encapsulate the concepts of compassion, impartiality, and acceptance (Shapiro et al., 1998). A critical key to mindfulness practice is not merely individual attention, but on how one attends to stimuli (Shapiro et al., 1998). The focus on the present moment should be aided by removing judgments about current thoughts, only examining them as a passive observer (Kabat-Zinn, 1994). The process of mindful and non-judgmental thought allows for a nonreactive awareness and emotional stability even in the face of anxiety-inducing stimuli (Carsley & Heath, 2018; Kabat-Zinn, 1994). The indirect goal of mindfulness practice is to create a “space” between individuals' perceptions of events and their responses, in essence, responding reflectively instead of reflexively (Bishop et al., 2004). Overall, the goal of a mindful state is experiencing what “actually is” instead of the preconceived notions of what “should be” (Mesmer-Magnus et al., 2017).

According to centuries of practice and contemporary research, the attainment of a mindfulness state is achievable for any individual (Kabat-Zinn, 1994). Contrary to common

misconceptions, the direct act of meditation is not a requirement for achieving a mindfulness state (Brown & Ryan, 2003). Other activities, such as yoga, mandala coloring, and rhythmic breathing, have been utilized to induce a mindful state (Bazzano et al., 2018; Carsley & Heath, 2018). Furthermore, a mindful state of consciousness is not always a conscious decision, as it can occur subconsciously or without guidance (Grossman et al., 2004). Another attention-related construct that is theoretically similar to mindfulness is flow. Flow, a high level of engagement with an optimally challenging activity, is characterized by high present moment awareness and a narrow attentional breadth (Dane, 2011). Flow is a unique operation where individuals are fully engaged in an activity to the point that it is semi-automatic, yet mindful that they can allow for insights to influence decisions (Nakamura & Csikszentmihalyi, 2014). Theoretical depictions of mindfulness and flow suggest that both constructs are accessed by high awareness to the immediate moment, but mindfulness is characterized instead by a broad attentional scope (Dane, 2011). While both experiences appear to be intertwined with signals of positive mental hygiene and high mental efficiency, research has suggested that the two experiences may be opposing in nature due to the way attentional awareness is utilized (Sheldon et al., 2015).

Procedure

At the most basic level, traditional mindfulness meditation practices follow the same general procedure. After the individual takes a seated or laying position, they will attempt to direct their attention and focus on their breathing. In the inevitable event of wandering attention, the individual takes notice of the wandering thoughts and gently guides focus back to their breathing. Grossman et al. (2004) provided an analogy about imagining looking at the sky on a clear day, seeing birds enter your field of view, but they do not stay. This process is repeated

each time attention wanders away, with an understanding that they will accept the wandering without judgment, action, or further elaboration (Kabat-Zinn, 2003).

After the general procedure is completed, multiple extensions can be taken to further the benefits of the meditation practice. Included in these are processes such as visualization and body scan. The visualization extension onto the meditation experience guides an individual to self-generate an idealized image of themselves, otherwise referred to as the “best-self” (Schussel & Miller, 2013). In general, a guided visualization meditation encourages the individual to mentally simulate an activity, such as removing an anchor while walking along a serene beachside. This encourages an individual to experience a sense of calm and "live in the moment" (Praissman, 2008). The overarching long-term goal for utilizing this strategy during guided meditation practice aims to allow individuals to establish a “coherent self” between their current actualization and the “best-self” (Schussel & Miller, 2013). Body scan extensions take a different direction of influence. Instead of visualizing the ideal self, body scan approaches direct meditators to gradually direct their attention to different parts of the body to bring attention and awareness to feelings and sensations throughout the body (Kabat-Zinn, 2013).

Mindfulness Benefits

Overall, mindfulness practice is proposed to offer several benefits to individuals who participate in regular practice. Included in the benefits are improvements in well-being, self-regulation, and attentional control.

Subjective Well-Being

Subjective Well-Being is a broad construct that includes individuals' emotional responses, specific satisfactions, and broad judgments about life satisfaction (Diener et al., 1999). The practice of various mindfulness exercises has been linked to improvements in

individual subjective well-being (Howells et al., 2016; Kang et al., 2018). These improvements to subjective well-being are facilitated by reducing emotional reactivity, indirectly improving the intensity of anxiety, depression, and stress reactions (Mesmer-Magnus et al., 2017). A potential explanation for this is that mindfulness allows for an individual to be more efficient with skills such as decentering (Bellinger et al., 2015). Decentering encourages self-reflection during experiences, for example, observing rather than judgment, allowing for increases in engagement with experiences instead of an avoidant mindset (Zoogman et al., 2015).

Bellinger et al. (2015) managed a series of studies that examined the impact of dispositional mindfulness on modular arithmetic performance with general and test anxiety as a mediator. The initial study specifically examined the relationship between mindfulness, state anxiety, and math performance during high-pressure situations. One hundred twelve undergraduate psychology students (Mean age = 20.05; 69.6% Female) were sorted into either high- or low-demand grouping for the modular arithmetic task. Anxiety was induced using performance-based pay and peer pressure. Mindfulness was assessed using three directed mindfulness surveys (Mindful Awareness Attention Scale; Toronto Mindfulness Scale), and anxiety was assessed using the State-Trait Anxiety Inventory. Using regression models and mediation analyses, the results from the initial study indicated that higher mindfulness was associated with increased math accuracy and significantly lower state anxiety scores. Additionally, the mediation model indicated that higher dispositional mindfulness reduced state anxiety when in a high-pressure testing situation, thus indirectly improving mathematics performance.

The second study conducted by Bellinger et al. (2015) tested the previous model of mindfulness in a more ecologically valid context. Using 248 freshman (24% Female)

engineering students, this study used course assignments and tests to replicate the high/low demand arithmetic laboratory task. Additionally, the STAI was replaced with the Cognitive Test Anxiety Scale. Once again, mindfulness predicted academic performance and negatively predicted cognitive test anxiety. The findings reinforced the initial laboratory study, with higher mindfulness predicting better course performance mediated by cognitive test anxiety. It is important to note that these results were found for exams and high-pressure assignments, not general homework assignments.

Self-Regulation

In addition to improvements to subjective well-being in individuals, self-regulatory capabilities are associated with higher academic self-regulation via endorsement of adaptive goals and actions to facilitate those goals (Howell & Buro, 2011). Additionally, reducing impulsive reactionary behaviors could improve problem-solving capabilities by reducing the urge to act (McCloskey, 2015; Mesmer-Magnus et al., 2017). This was observed in research that identified mindfulness as a key contributor in GRE preparation, with students scoring 16% higher between pre and post measurements (Docksai, 2013).

Cognition/Attentional Control

As individuals become more proficient in non-judgmental observation rather than reacting to stressful situations, their top-down control processes work in conjunction to cause a reduction of stress appraisal (Lee et al., 2016). These improvements in cognitive inhibition are definitive signs suggesting that mindfulness practices are effective in improving individual cognition, attention, and attentional control (Bishop et al., 2004; Jha et al., 2007). As meditation experience increases, research suggests, attention regulation will increase as well. For instance, sustained attention toward all experiences (i.e., sensory, cognitive) increases, while decreasing

behaviors such as reacting, elaborating, or evaluating (Bishop et al., 2004). Brief mindfulness interventions in classrooms have been shown to improve cognitive performance while also buffering individual resilience towards stress (Bazzano et al., 2018).

Mindfulness related to achievement has been seen to be a correlate of attentional control, among other variables (Brown et al., 2007). Specifically, increases in attention switching and sustainment have been related to mindfulness training (Chambers et al., 2008). Malinowski (2013) suggests that the somatosensory experience of breathing contributes to attentional control and cognitive flexibility, processes that are also central components of mindfulness practices.

Trait and State Mindfulness

Like test anxiety, mindfulness contains trait and state dispositions (Brown & Ryan, 2003; Howells et al., 2016). However, as with test anxiety research, the rates at which individuals experience the various states of mindfulness are inconsistent, thus suggesting that mindful states are a dispositional, or trait, property (Brown et al., 2007). Trait mindfulness is defined as stable individual differences in the inherent predisposition to mindfulness (Bergeron et al., 2016; Glomb et al., 2011). Dispositional trait mindfulness correlates with increased academic achievement compared to those with a low disposition (Brown & Ryan, 2003). Additionally, those with higher trait mindfulness reported lower rates of anxiety, influencing their performance on academic tasks that detrimentally impact working memory (Carsley & Heath, 2018). Furthermore, interventions targeting individuals dispositional and trait mindfulness have shown improvements for individuals, suggesting further that individuals trait mindfulness can be influenced naturally or through practice (Bellinger et al., 2015).

State mindfulness is the component of mindfulness that is variable across contexts and settings. As a result, those who are higher in trait mindfulness will, in turn, experience more

significant influence from their state mindfulness in the present moment (Mesmer-Magnus et al., 2017). Individuals can be considered mindless as well, or individuals who provide little conscious effort or attention to the present contexts (Langer, 2000; Radel et al., 2009). Individuals within this subgroup tend to rely heavily upon unconscious processes such as blindly following a routine and impulsive decisions in a robotic fashion (Radel et al., 2009).

Mindfulness Models

As mindfulness practice has gained popularity, researchers have taken steps in identifying models that adequately define and identify the various subcomponents that may be present. While each model contains a slightly different approach and perspective, each of them does agree upon the general definition provided by Kabat-Zinn (1994). There are many proposed mechanisms of change from these models, including metacognitive awareness, decentering, diffusion, reperceiving, reduced rumination, and attentional focus (Grabovac et al., 2011). The most prominent models that examine mindfulness originate from the cognitive, social-cognitive, and positive psychology fields. While there are many models present within the mindfulness literature, only five of the more significant models are included here.

Buddhist Psychological Model

The Buddhist Psychological Model (BPM) is posited by Grobovac & Lau (2011) and attempts to meld the eastern meditation philosophy and the contemporary western conceptualization of mindfulness meditation. Explained within this conceptualization, an overall relationship between an individual's trait mindfulness and their cognitive processes (Grabovac et al., 2011). According to this model, there is a clear distinction between mindfulness practice (referred to as insight practice, or *vipassana*) and attention-regulation (known as *samatha*).

In line with information processing models, BPM suggests that attentional resources are limited to one object at a time, and awareness is triggered when either cognition or sense is activated in the mind (Grabovac et al., 2011). When awareness is activated for an individual, they then place an immediate pleasant, unpleasant, or neutral tone to it (Grabovac et al., 2011). These tones do not refer to emotions such as anger or joy, but instead indicate the immediate affective reaction to an event (Mendis, 2006). By default, individuals will either approach or avoid the resulting emotions depending if the tones trigger an emotional chain reaction (Grabovac et al., 2011). Key to the BPM, when individuals react to the approach or avoidance, it is to the generated feeling but not the object that caused it (Grabovac et al., 2011).

Overall, the BPM contains three core characteristics: (1) Impermanence - mental events are transient, (2) Suffering - instinctive reactions (Approach or Avoidance) to the tones and a lack of awareness lead to discomfort, and (3) Not-self - these tones do not contain a lasting separate entity called a self (Grabovac et al., 2011; Nyanaponika, 2004). In the BPM, the defined goal is to achieve a balanced state, where an individual attends to tones with neither approach or avoidance (Grabovac et al., 2011). The model indicated a greater detachment from these feelings leads individuals to increased subjective well-being and decreased experiences of maladaptive symptoms.

Social Cognitive Theory of Mindfulness

Langer's (1992; 1997) social-cognitive theory of mindfulness is a westernized approach to mindfulness. This early conceptualization defined mindfulness as a conscious state of awareness and openness to novelty where individuals actively construct context and content instead of mindlessly and shallowly processing information (Langer, 1992). According to this model, the mindfulness construct revolves around five similar psychological states: openness to

novelty; alertness to distinction; sensitivity to different contexts; implicit awareness of multiple perspectives; and orientation to the present (Langer, 1997).

Openness to novelty is an individual's preclusion to being cognitively receptive toward novel information (Sternberg, 2000). This state of mindfulness allowing mindful individuals to be receptive to learning new content. Alertness to distinction suggests that mindful individuals exhibit detail-oriented attentiveness toward novel experiences (Langer, 1997). Another aspect of mindfulness is an individual's ability to exhibit sensitivity toward different contexts. Mindful individuals are more prone toward treating tasks differently when the contexts surrounding that activity change (Langer, 1997).

Additionally, Langer's (1997) approach indicates that awareness of multiple perspectives is a critical component. Similar to context-sensitivity, mindful individuals approach reality through perspective-taking and identifying multiple perspectives in any situation (Langer, 1997). Orientations to the present is a critical distinction that multiple conceptualizations of mindfulness support. A mindfully focused individual is one whose attention is immersed and enveloped in the immediate moment (Langer, 2000; Sternberg, 2000).

Positive State Mindfulness Multidimensional Model (PSM3)

Expanding upon the Langer social-cognitive theory of mindfulness, Ritchie & Bryant (2012) proposed that the notion of mindfulness is related to the construct of savoring, or the capacity to mindfully attend to positive thoughts and feelings about the past, present, or future (Bryant & Veroff, 2007; Ritchie & Bryant, 2012). Using savoring and the social cognitive models as a theoretical framework, the PSM3 suggests that there are three core components to the mindfulness construct: Focused attention, Novelty appreciation, and Open-ended expectations. In line with multiple other conceptualizations of mindfulness, a central component

is focused attention, or attention to the present moment is critical to enjoyment and absorption of positive experiences (Ritchie & Bryant, 2012). The second factor in the PSM3 (also consistent with Langer) is Novelty appreciation. In general, this factor is defined as individuals taking pleasurable appreciation of novel experiences (Ritchie & Bryant, 2012). The final factor in the PSM3 concerns individuals' levels of uncertainty and willingness to situationally accept a variety of experiences. The open-ended expectations factor primarily emphasizes the individual's tolerance for uncertainty in the present moment. What differentiates the PSM3 from the Langer model is examining mindfulness experiences through a positive experiential outlook.

Cognitive Model of Mindfulness

Utilizing a more technical approach to the mindfulness construct, Holas & Jankowski (2012) proposed a cognitive model of mindfulness (CMM). In general, it is suggested that mindfulness should be conceptualized as cooperation between executive functions and attentional processes to promote a meta-awareness state (Holas & Jankowski, 2013). Within the CMM, it is proposed that there are two general facets: (1) Intentional meta-awareness & (2) Open attitude to experiences (Holas & Jankowski, 2013).

Intentional Meta-awareness. Overall, the meta-awareness facet of this mindfulness model includes many characteristics: reduced dissociations, improved basic awareness, and decreased activation of ruminations. According to the CCM, individuals considered mindful are expected to experience fewer dissociations. In this context, dissociations are characterized by mind-wandering and daydreaming (Holas & Jankowski, 2013). Mindful individuals are more apt at acknowledging when they are having thoughts that are irrelevant to their current goals due to attentive information processing meta-awareness (Holas & Jankowski, 2013). In general, a mindful person will be better able to accurately and distinctly describe their personal experiences

(thoughts, emotions, & sensations) compared to a non-mindful individual (Brown & Ryan, 2003).

Open Attitude to Experiences. Related to the concept of open monitoring mindfulness training (vipassana meditation), this facet of the model concerns an overall interest in the various elements of novel experiences. For instance, some related aspects of openness to experience include emotional, cognitive, and behavioral elements (Holas & Jankowski, 2013). The openness to experiences facet of this model suggests that a mindful individual will explore experiences with an attitude characterized by openness and curiosity (Holas & Jankowski, 2013). Compared to the meta-awareness facet, this cognitive model segment concerns the critical nature of an individual's attitude when exploring mindfulness. Individuals who are more open to novel experience find themselves less burdened by evaluative processes resulting in increases in the overall meta-awareness related to the experience (Holas & Jankowski, 2013).

Bishop's Mindfulness Model

A prominent model and operational definition for the mindfulness construct is Bishop's Theory of Mindfulness (2004), a two-component model that centers around the self-regulation of attention and orientation to experience. Overall, this model categorizes mindfulness as attention regulating process that brings awareness and an orientation to experience events with curiosity, acceptance, and openness. These experiences will create insightful moments allowing individuals to understand the nature of their mind and allow for a decentered and transient perspective when encountering thoughts and feelings (Bishop et al., 2004).

Self-Regulation of Attention. The self-regulation of attention components of the mindfulness model involves the maintaining of focus, so it remains within the present experience (Bishop et al., 2004). The maintaining of focus allows for extended recognition of mental and

physical events occurring presently (Bishop et al., 2004). Sustained attention is a psychological construct that refers to the aptitude to maintain a state of awareness over extended periods, a construct that is key to this component of the theory (Bishop et al., 2004; Posner & Rothbart, 2000). During mindfulness meditation practice, the ability to maintain sustained attention on one's breath or visualization anchors attention to the present experience, as various sensations and thoughts can be detected passively as they arise (Bishop et al., 2004). In addition to sustained attention, this component utilizes an attention switching skillset that allows individuals to bring attention back to their anchor once a particular sensation or feeling has been detected (Bishop et al., 2004). Overall, this component of the model supposes that advancing mindfulness will relate to improvements in sustained attention and attention switching (Bishop et al., 2004). Therefore, the individual will be better able to quell task-irrelevant thought processes that arise in the consciousness, freeing up useable working memory (Bishop et al., 2004).

Orientation of Experiences. The second component within Bishop's mindfulness model is the orientation of experiences in the immediate moment, which is characterized by curiosity, openness, and acceptance of the moment cultivated within mindfulness practice (Bishop et al., 2004). During practice, the individual commits to maintain general curiosity to the wandering mind whenever it drifts away from the anchor point in addition to curiosity about elements within the immediate environment (Bishop et al., 2004). It is to this effort that the individual is not attempting to cultivate a sense of relaxation or influence feelings; the objective is to accept the experience and observe non-judgmentally (Bishop et al., 2004). Acceptance in this context is defined as an experiential openness to the current reality while abandoning attempts to generate a "different" experience (Bishop et al., 2004; Roemer & Orsillo, 2002). The predictions associated with this component of the mindfulness model asserts that the curiosity and acceptance adopted

during mindfulness practice will reduce avoidant cognitive and behavioral strategies and improve dispositional openness (Bishop et al., 2004). These outcomes would ensure that emotionally distressing moments (such as anxiety inducing experiences) will be perceived as less unpleasant and/or threatening (Bishop et al., 2004).

Mindfulness Interventions

Traditional Mindfulness Interventions

As mindfulness meditation gained recognition in clinical settings for stress and anxiety reduction, researchers sought to examine how these traditional Buddhist philosophies could be adapted for a broader audience. Many of these traditional approaches to mindfulness interventions had a duration of two months or more and prescribed daily involvement to improve personal insight and awareness.

Mindfulness-Based Meditation. With origins dating back to techniques practiced by the monastic Buddhist congregation, Mindfulness-Based Meditation (MBM) is recognized as an effective pathway towards focusing attention and developing balance in one's life (Gampopa, 2000). For centuries, MBM traditionally was practiced in eastern cultures before being westernized by Jon Kabat-Zinn (1982) at the University of Massachusetts. Historical meditation methods, such as transcendental meditation, train individuals to restrict attention on one solitary point for extended periods. The MBM approach emphasizes detached observation, continually changing field of awareness, instead of restricted attention (Kabat-Zinn, 1982). Contemporary MBM interventions contain multiple elements, including breath awareness, awareness of thoughts, and body scan (Kabat-Zinn, 2003; Kang et al., 2018).

Kang et al. (2018) recruited 100 sixth-graders (Mean age = 11.79; Females = 46%) to participate in a MBM intervention program. For six weeks, students were guided through

progressively longer meditation periods (3 minutes - 12 minutes; avg. 5 minutes) at the beginning of their daily classes. To measure the effectiveness of the intervention, pre-post measures for affect/well-being (Spielberger Anxiety Inventory - Child), mindfulness (Cognitive and Affective Mindfulness Scale), and compassion (Self-Compassion Scale) were utilized. The results of the MBM intervention revealed that female students experienced improved emotional well-being compared to control groups, whereas male students did not experience the same improvements. Kang et al. (2018) hypothesized that this was due to stronger self-compassion for female students but not male students.

Mindfulness-Based Stress Reduction. Mindfulness-Based Stress Reduction (MBSR) is a structured therapeutic approach that brings together MBM and Hatha Yoga (Gazella, 2005). Hatha Yoga is a meditative exercise that focuses on encouraging mindful awareness during movement and posture (Kabat-Zinn, 1982). Yoga is proposed to support mindfulness because when the mind is focused on maintaining posture, there is a lower chance of interfering thoughts and emotions (Shapiro et al., 1998). The MBSR intervention is free from cultural and religious influence. Instead of teaching Buddhism, the intervention is designed to create an environment that methods of relieving the suffering of the mind and body can be used freely while promoting the connection between mind and body (Kabat-Zinn, 2003). The core formalized MBSR training experience is an eight-week course. Participants are instructed to meet once weekly for 2.5 hours, with a one-day silent retreat (sixth week). Throughout the 28-30 hours of instructional time, participants are taught meditation methodology to tune bodily awareness. Daily homework (35 minutes of formal practice, 15 minutes of informal practice) is also assigned for participants. Formal practice includes body scan, mindful movements, hatha yoga, and sitting meditation.

Informal practice includes awareness of daily routines, communication, and pleasant/unpleasant events (Kabat-Zinn, 1992).

Shahidi et al. (2017) conducted a study examining the effectiveness of an MBSR therapy intervention on test anxiety and emotion regulation. Using 50 high school students identified as having high test anxiety were randomly divided into two groups (MBSR, Control). These students were given pre-post measures of test anxiety (The Test Anxiety Scale) and emotional regulation (Cognitive Emotion Regulation Questionnaire) as bookends for the eight-week MBSR training. A repeated-measures ANOVA indicated that the MBSR program had significant effects on test anxiety and emotion regulation. Shahidi et al. (2017) concluded that these effects were seen because MBSR helps develop conscious non-judgmental attitudes, thus improving emotion regulation and reducing test anxiety experiences.

Mindfulness-Based Cognitive Training. Mindfulness-Based Cognitive Training (MBCT) was designed to help depression patients become more aware of and disengage from their negative ruminative thought processes to prevent relapse (Teasdale et al., 1995). MBCT is an integration between MBSR and cognitive-behavioral techniques utilized in the treatment of depression symptoms (Teasdale et al., 2000). The emphasis in the MBCT treatment is not about changing the thoughts themselves, but to change the relationship between individuals and their thoughts using a decentering approach (Teasdale et al., 2000). The therapy consists of eight two-hour weekly sessions that include daily homework in-between sessions. The assignments are focused on teaching and reinforcing awareness in daily life through guided awareness exercises (Teasdale et al., 2000). The key feature of this intervention program is enabling intentional awareness and freedom of choice instead of habitual, automatic behavior.

Lever Taylor et al. (2014) conducted a study to determine the effectiveness of the MBCT-SH (self-help version) for students. The hypothesis indicated that the program would reduce anxiety, depression, and stress while improving life satisfaction, mindfulness, and compassion. Using 79 undergraduate students (Mean age = 28.61; Female = 81%) within a United Kingdom University, participants in the intervention condition were instructed to read one chapter weekly from an eight-chapter MBCT self-help book. The book instructed students to attend to the internal and external worlds while maintaining a grounded perspective (Wiliams & Penman, 2011). Additionally, participants were instructed to follow along with CD-based meditation instructions between chapters. Pre-post measurements were taken using the following scales: Depression, Anxiety, and Stress Scale - Short Form, Satisfaction with Life Scale, Five Facet Mindfulness Questionnaire, Self-Compassion Scale - Short Form, & self-report engagement. The results from the study indicated that the self-help version of the MBCT significantly reduced depressive, anxiety, and stress symptoms. Additionally, a follow-up measurement showed no significant changes suggesting that the effect maintained post-intervention.

Brief Mindfulness Interventions

Considering the amount of support for traditional mindfulness interventions, researchers have begun to explore if the extended duration is necessary to improve individuals state and trait mindfulness. As a result, many studies have utilized multiple definitions of "brief" mindfulness interventions ranging between 4-weeks and 5-minutes. The scope of this investigation will only focus on mindfulness interventions that only require a single brief session (< 1 Hour). While single session mindfulness interventions are limited in availability, the following eight studies highlight techniques that have been utilized to induces a mindful state in participants.

Weger et al. (2011) conducted a study aiming to determine if a brief mindfulness intervention reduces experiences of stereotype threat. With 71 female psychology students (Mean age = 20.14), participants were randomly assigned to one of four groups: (1) Stereotype threat + mindfulness, (2) No stereotype threat + mindfulness, (3) Stereotype threat + no mindfulness, and (4) No stereotype threat + no mindfulness. The brief mindfulness intervention in this study was the "Raisin Task". Participants in this task listened to a 5-minute audio recording providing instruction on how to enjoy eating a raisin. Participants are supposed to imagine eating a raisin for the first time, attending to multiple sensory experiences. This intervention is designed to strengthen participants' awareness of the present. Mindfulness is measured pre-post a math task using the Toronto Mindfulness Scale. The primary findings of the 2x2 factorial ANOVA indicate that mindfulness was significantly higher than the post-intervention, and stereotype threat was reduced for those engaged with the mindfulness task. Weger et al. (2011) suggest that stereotype threat fills working memory capacity, and the brief mindfulness intervention counters this debilitating impact allowing for more capacity to be utilized during exam situations.

Kiken & Shook (2011) conducted a study to determine if a brief induction of mindfulness will reduce negativity bias is participants. Using 175 undergraduate psychology students (53% Female, mean age = 19.6), participants are divided into an experimental and control condition. In the experimental condition, participants are guided through a 15-minute mindful breathing process. The task instructs participants to anchor their thoughts and attention to the quality of their breathing, merely experiencing the process of breathing instead of controlling it. Those in the control condition receive instructions about mind wandering or encouraging participants to allow their mind to wander freely. All participants had to complete a digital game task where

they were instructed to select "good" beans. Other measurements used in this study included: Future events scale, Mindful Attention Awareness Scale, and the Positive and Negative Affect Schedule. A series of t-tests and ANOVAs revealed that the mindfulness induction condition was more accurate at identifying positive stimuli during the performance measure. The link between mindfulness and higher positivity is hypothesized to occur because mindfulness reduces rumination and allows for greater availability of attentional resources.

Alberts (2011) conducted a study to determine if a brief mindfulness intervention improves individual's non-judgmental observation of stimuli. After recruiting 40 undergraduates (Mean age = 21.6; Female = 50%) from Maastricht University, participants were evenly distributed between a control and mindfulness condition. In this study, the mindfulness condition induced a mindful state via a 12-minute audio instruction guiding participants to control their breathing and focus their attention. All participants completed a mindfulness questionnaire and a verbal learning test before completing a distraction task (Tetris). After the distraction, participants were asked to recall words from the verbal task. Results showed that those in the mindfulness induction group reported significantly higher mindfulness compared to the control condition. Additionally, there were no differences in accuracy of recall, but those in the mindfulness group recalled significantly less negatively valanced words. The outcomes from this study suggest that heightened mindfulness potentially neutralizes the "negative" content allowing it to have a diminished impact on memory, thus allowing for more working memory availability for positive information.

Mrazek et al. (2012) conducted a series of studies to determine the relationship between mindfulness and mind-wandering. The initial study contained 117 undergraduate students (Females = 71.7%) at the University of California. In this study, participants completed a 10-

minute mindful breathing task with thought probes, 10-minute mindful breathing with self-catching of mind-wandering, and a 10-minute SART. The thought probe task asked participants at random intervals if their attention was still on the breathing task. The self-catching task had participants press a key whenever they caught their attention wandering. The SART is identified as a task that is an indirect measure of mind-wandering. Additionally, participants were measured using the positive and negative affect schedule, mindfulness attention awareness scale, and the imaginal processes inventory. The results from correlational analyses concluded that trait mindfulness and trait mind wandering are negatively related.

The second study from Mrazek et al. (2012) attempted to determine if mindfulness can attenuate mind wandering. Sixty participants (Female = 66%) were divided into three groups (mindful breathing, passive relaxation, or reading) and were asked to complete the same SART task from the initial study. Results revealed that the eight-minutes of mindful breathing significantly reduced the indirect markers of mind wandering. Mrazek et al. (2012) were not able to determine the mechanism that reduced the occurrence of unrelated thoughts after mindfulness practice.

Daniel (2014) conducted a study with 28 female undergraduate students that contained four conditions to measure if mindful breathing would reduce perceptions of stereotype threat and improve math achievement, metacognitive awareness, mood, mindset, and effort. The four conditions were as follows: (1) Only stereotype activation, (2) No stereotype activation, (3) Stereotype activation + relaxation, and (4) Stereotype activation + mindfulness meditation. The relaxation condition had individuals listen to music for 10-minutes while the meditation condition contained a 10-minute breathing meditation audio file. Utilizing an ANOVA analysis, the results indicated that participants in the mindfulness meditation condition performed

significantly higher on the math achievement test and effort compared to other conditions. No other measured variable contained significant differences. Daniel (2014) posits that these results provide evidence for brief mindfulness interventions, and that once stereotype threat is activated, it is possible to reduce it.

Bonamo et al. (2015) conducted a study to determine how brief mindfulness exercises enhance the processing of novel words. Participants (136 Females; Mean age = 19.46) completed the following scales: Toronto Mindfulness Scale, State-Trait Anxiety Inventory, Center for Epidemiologic Studies Depression Scale, Adult ADHD Self-Report Scale, and the Five Facets Mindfulness Questionnaire. After being divided into three groups (20-min body scan meditation, 45-minute body scan meditation, and control group), participants completed their meditation task and then viewed Swahili-English word pairs. Following a distraction arithmetic task, participants were prompted to free recall the English term of Swahili learned earlier. The results showed that both mindfulness groups had better word recall than the control group. Additionally, measures of state mindfulness were not significantly different between the control and the 45-minute body scan meditation group. Bonamo et al. (2015) suggest that this particular result suggests that extended duration mindfulness exercises may cause participants to become bored, restless, or irritated.

Mahmood et al. (2016) conducted a series of studies that aimed to examine the effectiveness of a five-minute digital mindfulness intervention. The first study included 54 undergraduate students (Female = 94%) who were asked to complete a pre-post state mindfulness measure (Toronto Mindfulness Scale) and a five-minute body scan meditation task. The results of the first study indicated that there were no significant differences in state mindfulness. The second study included 90 Amazon Mechanical Turk participants who

completed the same tasks and measures as study 1, except in an online format. The second study results revealed that there were significant differences in state mindfulness between the mindfulness and control groups. The third study, conducted through Amazon Mechanical Turk, recruited 61 participants (Mean age = 33.56; Female = 39%). The third study utilized the same measures and tasks, but data was collected prior to and after the mindfulness task. The results indicated that those in the mindfulness condition scored significantly higher on the state mindfulness measure. Mahmood et al. (2016) posited that allowing participants to mediate in the comfort of their personal surroundings may increase the intervention's effectiveness.

Carsley & Heath (2018) conducted a study to determine the effectiveness of a mindful art activity in reducing test anxiety in 4-6 grade students. Participants included 152 students (Mean age = 10.38, Female = 50%) from public elementary schools in Montreal. The constructs that were measured pre-post in this study included: anxiety (STAIC-S), state mindfulness (Mindful Attention Awareness Scale - State), and trait mindfulness (Child and Adolescent Mindfulness Measure). The intervention task was a mandala coloring task lasting 15-minutes, while the control task was a free-drawing task in the same duration. The results showed that test anxiety was significantly reduced for both drawing conditions, with no differences observed between gender. Additionally, a ceiling effect was observed in the results, suggesting that those with higher trait mindfulness do not need an intervention to improve mindfulness.

Test Anxiety Mindfulness Intervention Research

Research utilizing mindfulness interventions to reduce test anxiety is limited in availability. Furthermore, there are even fewer studies that examine intervention effectiveness in university populations. Many mindfulness interventions are directed at a K-12 population or are interested in reducing general anxiety symptomology. Consequently, only four studies directly

examined the reduction of test anxiety in undergraduates through mindfulness interventions of any variety or duration.

Hjeltnes et al. (2015) conducted a qualitative study where 29 students (25 Female; Mean age = 28) experiencing high academic evaluation anxiety from the University of Bergen, Norway, were enrolled in an eight-week MBSR course. The semi-structured interviews were conducted with participants at the conclusion of the course. The analysis of transcribed interviews followed explorative-reflective thematic analysis, revealing five primary themes. The participants felt that the MBSR course provided a method to find inner calm during times of stress and anxiety. Also, participants indicated that having a group experience reduced feelings of shame and increased understanding of anxiety during evaluative situations. Another highlighted theme was that the MBSR exercises allowed individuals to stay focused in various learning situations. Participants also reported using different approaches to learning, utilizing more mastery orientations instead of fear of failure. Finally, participants felt the MBSR allowed for more feelings of self-acceptance.

Cho et al. (2016) conducted a study to examine the efficacy of daily mindful breathing in reducing test anxiety and automatic thoughts. Using psychology students at Yeungnam University in South Korea, high test anxious students (N = 36; Mean age = 20.1; Female = 58.3%) were evenly divided into three groups (Mindful breathing practice, cognitive reappraisal, and a control group). Students in the experimental and contrast conditions were instructed to conduct daily practice for a week. In a pre-post collection, participants completed measures of test anxiety (Revised Test Anxiety), positive thoughts (Automatic Thoughts Questionnaire - Positive), and positive affect (Positive and Negative Affect Schedule). The results revealed two critical findings through Repeated Measures MANOVAs and follow-up Univariate Repeated

Measures ANOVA's. First, the mindful breathing and cognitive reappraisal interventions reduced test anxiety compared to the control group. Second, mindful breathing significantly increased positive automatic thoughts over time compared to the other two conditions.

Sampl (2017) conducted a randomized intervention study to determine if a mindfulness-based leadership training intervention would improve academic achievement, test anxiety, and academic self-efficacy. Using 109 undergraduates (Mean age = 21.39; Female = 75%) from the University of Innsbruck completed a ten-week intervention program designed to educate participants on mindfulness techniques adapted from Kabat-Zinn (2003) and self-leadership training. The pre-post measures in this study included: Mindful Attention and Awareness Scale, Revised Self-Leadership Questionnaire, Perceived Stress Questionnaire, German Test Anxiety Inventory, & the Self-Efficacy Scale. The results determined, through a series of t-tests and ANOVAs, that the intervention successfully increased students' academic performance, trait mindfulness, and attenuating test anxiety. The test anxiety results suggested that the intervention-maintained levels of test anxiety rather than allowing them to increase during times of increased academic pressure.

Lothes et al. (2019) conducted a study to measure the effectiveness of DBT mindfulness training on test anxiety in college students in a face-to-face or digital format. Forty-three students (Mean age = 19; Female = 58%) from a southeastern university were assigned to one of the three groups. The measures utilized in this longitudinal study were the Test Anxiety Inventory, State-Trait Anxiety Inventory, Five Facets of Mindfulness Questionnaire, & the Mindfulness Attention Awareness Scale. The eight-week DBT/MBSR intervention was delivered in an identical method despite the distance learning design of the online intervention group. Measurements were taken at the first, fourth, and eighth week of the intervention along with a 6-month follow-up. The

within-groups ANOVA revealed that the face-to-face intervention reduced worry and emotionality components of test anxiety while increasing self-report ratings of mindfulness. Furthermore, the 6-month follow-up revealed that test anxiety remained significantly lower for the face-to-face intervention group. The distance learning intervention group showed a significant effect of reducing test anxiety over time while also increasing mindfulness (six-month follow-up data not completed yet). The control did not show any significant differences in test anxiety or mindfulness. These outcomes indicate that the delivery methods for mindfulness interventions, digital or physical, are not significantly different, while the intervention overall effectively reduces test anxiety.

Chapter 3: Methodology

Participants

In order to determine the number of participants necessary for the proposed analyses, a series of a priori power analyses were conducted with G*Power 3.1. Empirical literature examining the efficacy of mindfulness-based interventions has demonstrated a range of effect sizes. Meta-analyses have demonstrated increases in mindfulness due to these interventions are in the medium range (Eberth & Sedlmeier, 2012; Giluk, 2009; Visted et al., 2015). A power test for linear multiple regression with six predictors, $f^2 = .15$ (medium effect), $\alpha = .05$, power $(1-\beta) = .95$ resulted in a desired sample size of n = 146. A power test for a Mixed MANOVA with a f^2 of .25 (medium effect), $\alpha = .05$, power $(1-\beta) = .95$, two groups, and nine response variables yielded a requisite sample size projection of n = 26.

Participants in this 2-session study (n = 138, M = 21.5; SD = 4.96) were undergraduate students recruited from a medium-sized public university. In the Midwest region of the United States. Students were primarily recruited from departmental research pools. Traditionally, university department pool utilization results in stacked sampling demographics with overrepresentation from Caucasian females. Additional recruitment efforts were made through university-wide e-mail solicitation. Participants recruited through the departmental research pools could use this participation as one of several options to satisfy a course requirement (students received course credit for participation in the first of two sessions). All participants who completed the second session of data collection were entered into an equal opportunity drawing to receive one of five $20 gift cards.

After data collection was completed, a total number of 191 started the study by accessing the consent form. Of these, 145 individuals completed the first session, whereas 80 participants returned to complete the second session. This results in an attrition rate of 24.1%.

Materials

Guided Meditation Video Intervention

The manipulation condition in this study took place only in the second session of data collection. During that session, each participant was randomly assigned to one of two conditions (Guided Mediation, Relaxing). The conditions were identical save for the introduction of guided mediation instruction in the "Guided Meditation" condition. First, participants were informed that would be watching a video prior to the quantitative examination. Both conditions received identical text instructions prior to the video intervention. Instructions informed participants that the video would be 17 minutes in duration and they were recommended to arrange themselves in a comfortable position in a space where they would not be distracted (headphones encouraged).

In the Guided Meditation condition, participants were greeted with one minute of information explaining the general concept of mindfulness and the upcoming meditation tasks. Following this, participants were guided through step-by-step instructions to engage in meditation activities including: establishing appropriate body position, guided breathing, body scan, and a brief visualization exercise targeting test anxiety (Appendix A).

Individuals assigned to the Relaxing condition viewed a video that contained identical visual and audio backgrounds, with the exclusion of the guided meditation instruction. That is, both conditions were built from the same video of background music, crashing waves, and drone footage of tropical beaches, but the Relaxing condition involved no additional guidance

following the initial shared instructions of getting comfortable and removing distractions from their environment prior to starting the video.

Five Facet Mindfulness Questionnaire (FFMQ)

The FFMQ (Baer et al., 2006) is a 39-item self-report measure examining trait mindfulness utilizing a five-point Likert-type scale [(1) *Very rarely true* – (5) *Almost always true*; Appendix B]. The scales have demonstrated trait mindfulness as a multidimensional construct, including observing, describing, acting, nonjudgement, and nonreactivity (Baer et al., 2006). The FFMQ demonstrates acceptable internal consistency between .76 and .91, and factor analyses provide construct validity for the scale structure (Baer et al., 2006).

Table 1. Five-Facets Mindfulness Questionnaire Subscale Reliability Statistics

Subscale	Mean	Std. Dev.	Cronbach's α	McDonald's ω
Observing	3.24	.67	.79	.78
Describing	3.11	.74	.85	.85
Acting	2.87	.80	.90	.90
Non-Judging	2.95	.91	.92	.92
Non-Reactivity	2.95	.64	.78	.79

State Mindfulness Scale (SMS)

The State Mindfulness Scale is a 21-item self-report measure designed to assess the respondents' awareness and attention to experiential events and objects within the last 15 minutes (Ruimi et al., 2019). Exploratory and confirmatory factor analyses support a higher-order two-factor solution for the scale, thus providing construct validity. Survey responses are on a five-point Likert-type scale [(1) *Not at all* – (5) *Very well;* Appendix C] with higher response averages indicating higher levels of state mindfulness. The current examination's internal consistency analysis revealed excellent reliability ($\alpha = .95$, McDonald's $\omega = .96$) replicating previous examination ($\alpha = .94$; Ruimi et al., 2019).

State-Trait Anxiety Inventory (STAI)

The STAI is a 40-item measure designed to measure state and trait anxiety factors in high school and college students (Spielberger, 1983). The survey instrument utilizes a four-point Likert-type scale [(1) *Almost never* - (4) *Almost always;* Appendix D; Spielberger et al., 1983]. For each of the factors, higher scores indicate elevated anxiety. On the Trait anxiety subscale, Cronbach's α ranged between .73 - .86, while on the State anxiety subscale, initial reliability assessments were less than ideal (α = .16 - .62; Spielberger et al., 1983). Factor analyses conducted by Spielberger et al. (1983) provided support that items evenly split into two subscales (State, Trait). These subscales additionally strongly correlated (*r* =.52 – 85) previous corresponding measures of test anxiety (Spielberger, 1983). More recent studies with the popular scale reported the reliability of the instrument between .78 & .79 (Vitasari et al., 2011). The current examination reported strong internal consistency for both subscales (State - α = .92, McDonald's ω = .92; Trait - α = .91, McDonald's ω = .91).

Big Five Inventory (BFI)

The BFI (Oliver P. John & Srivastava, 1999) is a 44-item measure that assesses five broad personality dimensions (extraversion, agreeableness, conscientiousness, neuroticism, and openness) recommended by Tupes and Christal (1961) and replicated in literature. Using a five-point Likert scale [(1) *Disagree strongly* - (5) *Agree strongly*; Appendix E], participants identify how accurately each statement describes them. The BFI personality subscales exhibited acceptable internal consistency in previous examinations [extraversion (α = .89), agreeableness (α = .86), conscientiousness (α = .83), neuroticism (α = .84), and openness (α =.79; Thomas & Cassady, 2019]. Additionally, previous examinations provided content and convergent validity

support via factor analytic approaches supporting the structure of the BFI with other personality scales.

Table 2. Big Five Inventory Subscale Reliability Statistics

Subscale	Mean	Std. Dev.	Cronbach's α	McDonald's ω
Extraversion	3.22	.82	.87	.88
Agreeableness	3.94	.56	.74	.74
Conscientiousness	3.54	.64	.79	.80
Neuroticism	3.23	.78	.82	.82
Openness	3.48	.56	.70	.74

Cognitive Test Anxiety Scale -Second Edition (CTAS-2)

The Cognitive Test Anxiety Scale – Second Edition is a 24-item measure designed to assess individuals' experiences with cognitive test anxiety in the academic context (Thomas et al., 2017). Participants report how well each of the statements describe their experiences using a four-point Likert-type scale [(1) *Not at all like me* – (4) *Very much like me*; Appendix F]. Previous examinations provide evidence suggesting excellent internal consistency and construct validity (α = .96; Cassady & Finch, 2015). The present examination's internal consistency analysis indicated excellent reliability with the CTAS-2 (α = .96, McDonald's ω = .96).

Demographic Questionnaire

Participants also completed a brief questionnaire requesting basic demographic information, including gender, age, ethnicity, academic major, years in college, cumulative GPA, prior experience with meditation or mindfulness practices.

Procedure

When respondents clicked on a link embedded within a recruitment e-mail, they were directed to the Qualtrics online data collection environment. Before seeing survey items, participants completed a virtual informed consent document that explained the study in detail (including the expectation that this involved two data collection sessions). After verifying they

met the age requirement of 18 years old or greater and agreeing to continue the study, participants were first introduced to three practice GRE quantitative reasoning items. The math items' presence was to activate or induce test anxiety in individuals (Jamison et al., 2010). Individuals were instructed that they would be asked to complete a challenging math exam designed to assess university-level mathematics ability in the second session.

Following the sample GRE items, participants were presented with the session one surveys (FFMQ, SMS, STAI-S, STAI-T, BFI, & CTAS2), presented in a randomized order to control for order effects. After the participants completed the primary study surveys, they finished session one by completing demographic surveys. This was presented last to minimize any effects of stereotype threat (Martella et al., 2013). Finally, participants provided a contact email so they would be contacted with the link for Session 2.

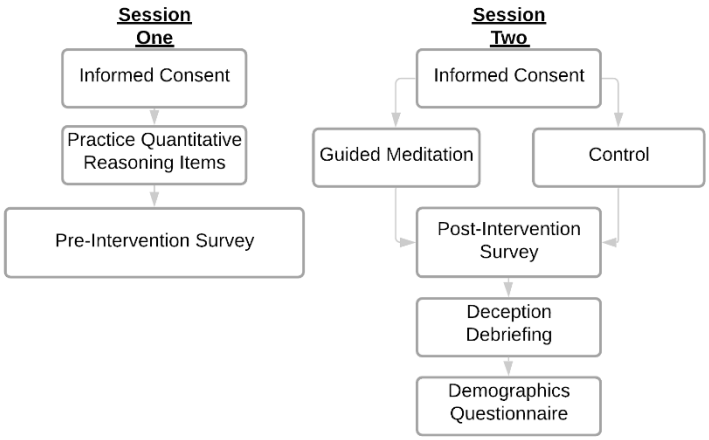


Figure 3.1. Study Procedure

Three days after completing the initial data collection session, participants received an automated email to the email address provided in the first survey. Similar to session 1, participants were provided with an embedded link directing them to Qualtrics. Once again, they were shown the informed consent document and had to agree to continue before seeing the rest

of the study materials. When the participants clicked to grant consent, they were subsequently divided into one of two conditions (random assignment with control over the assignment to ensure even group sizes): (1) the Guided Meditation Video, or (2) a Relaxing Video. During these conditions, participants were asked to watch their assigned video and follow along with the instructions that are detailed in the materials section. After they completed viewing their assigned video, participants completed posttest measures of the mindfulness and test anxiety instruments (FFMQ, SMS, STAI, & CTAS2) which were once again presented in a randomized order.

After completing the surveys, the respondents were given a deception debriefing explaining that they were not going to be completing the GRE quantitative reasoning test suggested in section one. They were informed why the deception took place (to activate potential test anxiety) and were provided with resources to contact if they were feeling any stress or anxiety brought about based on their participation in the study. Post-debriefing, participants in each condition will be asked if they had any previous mindfulness experience and follow-up questions requesting further detail in their mindfulness experiences.

Chapter 4: Results

The purpose of this study aims to expand upon previous research by examining the efficacy of a brief digital mindfulness intervention in decreasing anxiety, test anxiety, and increasing mindfulness. Specifically, this study will investigate the following research questions: *RQ1: Do brief digital mindfulness interventions influence student anxiety and mindfulness?* The null hypothesis is that individuals will not significantly impact anxiety or mindfulness regardless of the assigned intervention condition. However, alternative hypotheses based on previous literature:

H1a: Individuals who engage in the guided meditation intervention will experience significantly improved state mindfulness, as compared to participants in the relaxing condition.

H1b: Individuals who engage in the guided meditation intervention will experience significantly improved state anxiety, as compared to participants in the relaxing condition.

H1c: Individuals who engage in the guided meditation intervention will experience significantly improved test anxiety, as compared to participants in the relaxing condition.

H2a: Individuals will not experience significant changes in trait anxiety, regardless of group assignment.

H2b: Individuals will not experience significant changes in trait mindfulness regardless of group assignment.

RQ2: Do personality traits predict mindfulness and student anxiety? The null hypothesis associated with this research question is that Big Five personality traits will not reliably predict

trait mindfulness nor trait anxiety. Therefore, the a priori alternative hypotheses based on previous literature:

H3a: The openness personality trait will significantly predict trait mindfulness.

H3b: The neuroticism personality trait will significantly predict trait anxiety.

Descriptive Statistics

Descriptive statistics for included study variables are provided in Table 3 in addition to correlation, reliability, and normality statistics from session one data collection. Correlational analysis results revealed many significant relationships between included variables. While significance is a common element used to determine the strength of observed relationships between variables, examinations of the magnitude of the relationships are more beneficial as they are less impacted by sample size bias. Therefore, observed relationship strength is determined via guidelines set forth by Cohen (1988) noting if variable relationships are considered *weak* ($r <$ .30), *moderate* ($r <$ .50), or *strong* ($r \geq$ .50). As expected, the neuroticism personality subscale carried strong positive relationships with all the included anxiety scales and strong negative relationships with trait mindfulness (FFMQ) subscales. Additionally, there are moderate positive relationships between participants' age and the conscientiousness and describing subscales, respectively. Participant GPA also carried moderate negative relationships with measures of cognitive test anxiety (CTAS-2).

Table 3. Descriptive statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	–															
2. GPA	-0.07	–														
3. Extraversion[a]	0.04	-0.07	–													
4. Agreeableness[a]	0.12	0.09	0.11	–												
5. Conscientiousness[a]	0.30***	0.21*	0.18*	0.49***	–											
6. Neuroticism[a]	-0.17*	-0.05	-0.29***	-0.15	-0.21*	–										
7. Openness[a]	-0.07	0.05	0.23**	0.06	-0.05	0.05	–									
8. SMS	-0.03	-0.02	0.15	-0.01	0.08	0.09	0.22*	–								
9. Observing[b]	0.09	-0.05	0.15	0.01	-0.05	0.07	0.37***	0.51***	–							
10. Describing[b]	0.32***	0.05	0.23**	0.17*	0.21*	-0.34***	0.13	0	0.18*	–						
11. Awareness[b]	0.16	-0.02	-0.02	0.17	0.41***	-0.37***	-0.22**	-0.14	-0.28***	0.20*	–					
12. Nonjudging[b]	0.18*	-0.02	0.12	0.26*	0.22*	-0.53***	-0.22**	-0.23**	-0.27**	0.35***	0.50***	–				
13. Nonreactivity[b]	0.09	-0.01	0.20*	0.07**	0.04	-0.43***	0.12	0.09	0.38***	0.28**	-0.07	0.04	–			
14. STAI-T	-0.19*	0.01	-0.29***	-0.30	-0.29***	0.70***	0.06	0.07	0.10	-0.47***	-0.48***	-0.71***	-0.32***	–		
15. STAI-S	-0.24**	-0.06	-0.23**	-0.25***	-0.36***	0.56***	-0.01	-0.03	0.09	-0.39***	-0.47***	-0.56***	-0.22**	0.79***	–	
16. CTAS-2	-0.08	-0.24**	-0.14	-0.05**	-0.08	0.45***	0.04	0.26**	0.21*	-0.25**	-0.37***	-0.36***	-0.10	0.48***	0.46***	–
Session 1 (N=140)																
Mean	21.50	3.41	3.22	3.93	3.52	3.24	3.48	2.16	3.25	3.11	2.85	2.95	2.94	2.4	2.33	2.44
Standard Deviation	5.01	0.46	0.81	0.56	0.63	0.78	0.57	0.89	0.68	0.74	0.77	0.90	0.63	0.52	0.53	0.74
Skew	-	-	0.04	-0.28	0.20	0.06	-0.10	-0.19	-0.17	0.26	-0.05	0.04	-0.08	0.17	0.14	-.08
Kurtosis	-	-	-0.67	-0.71	-0.49	-0.66	-0.14	-0.13	-0.17	0.40	-0.18	-0.42	0.16	-0.20	0.13	-0.86
Cronbach's α			0.87	0.74	0.79	0.82	0.70	0.95	0.79	0.85	0.90	0.92	0.78	0.91	0.92	0.96
Session 2 (N = 76)																
Mean	-	-	-	-	-	-	-	2.55	3.32	3.12	2.71	2.83	2.95	1.93	2.31	2.41
Standard Deviation	-	-	-	-	-	-	-	0.76	0.67	0.72	0.75	0.97	0.62	0.60	0.57	0.84
Skew	-	-	-	-	-	-	-	-0.22	-0.26	0.50	0.19	0.09	-0.25	0.48	0.38	0.06
Kurtosis	-	-	-	-	-	-	-	-0.47	-0.06	-0.32	0.36	-0.61	-0.11	-0.13	-0.08	-0.97

Note - * p < .05, ** p < .01, *** p < .001; [a] – Big Five Inventory subscale; [b] – Five Facet Mindfulness Questionnaire Subscale; SMS – State Mindfulness Scale; STAI – State Trait Anxiety Inventory - Trait Version; STAI – State Trait Anxiety Inventory - State Version; CTAS2 – Cognitive Test Anxiety Scale Second Edition

Background Information

Of the participants enrolled in the study, 79.4% of participants identified themselves as Female, while 80% identified themselves as Caucasian. As such, 65.5% of the sample were Caucasian females, a significant majority (See Table 4). There was acceptable representation from each of the academic years enrolled. Additionally, there were no significant differences reported in GPA between gender (Male – 3.44, Female - 3.41), yet freshman participants reported a higher GPA (3.68) compared to all other academic groupings (Sophomore – 3.33; Junior – 3.41; Senior – 3.34).

Table 4. Participant Demographics

	Session 1		Session 2			
	Overall		Guided		Relaxed	
	n	%	n	%	n	%
Gender						
Female	112	79.4	27	72.9	29	74.3
Male	29	20.6	10	27.0	10	25.6
Ethnicity						
Caucasian	112	80.0	31	83.7	33	84.6
African American	13	9.3	1	2.7	1	2.5
Hispanic	5	3.6	1	2.7	2	5.1
Asian	7	5.0	3	8.1	2	5.1
Pacific Islander	1	0.7	0	0.0	0	0
Multi-Racial	2	1.4	1	2.7	0	0
Year in University						
Freshman	21	14.9	3	8.1	5	12.8
Sophomore	41	29.1	12	32.4	9	23.0
Junior	33	23.4	7	18.9	12	30.7
Senior	40	28.4	13	35.1	10	25.6
Graduate	6	4.3	2	5.4	3	7.7

Differences between groups based on Session and Group

Mixed MANOVA Assumptions

When conducting a mixed MANOVA analysis, multiple assumptions need to be assessed. In addition to the basic features of multiple dependent variables, multiple independent variables, utilization of continuous variables, and independence, key assumptions include sample size, multivariate outliers, multivariate normality, linearity, and homogeneity of variance-covariance matrices (Hahs-Vaughn, 2017).

For this study, sample sizes desired for target analyses were calculated utilizing G*Power 3.1. The desired sample size for a mixed MANOVA with a f^2 of .25 (medium effect), $\alpha = .05$, power $(1-\beta) = .95$, two groups, and 9 response variables yielded a requisite projection of $n = 26$. The included mixed MANOVA analysis contained $n = 78$ ($n = 39$/group) meeting the power analysis recommendations.

Statistical analyses are generally susceptible to the presence of outliers that have been shown to contribute to bias in researcher inferences (Tabachnick & Fidell, 2013). Types of

interference include Type I and II error rate, statistical power reduction, and biased estimates of parameters (Hahs-Vaughn, 2017; Tabachnick & Fidell, 2013). Univariate outliers in the current examination were determined by raw scores that exceed 3.29 standard deviations from the mean value (Leys et al., 2019; Tabachnick & Fidell, 2013). Examination of data visualizations using this parameter identified five outliers across the nine dependent variables. Participants identified as outliers were removed from all analyses associated with these cases were removed before primary analyses. Following the univariate outlier detection, Mahalanobis distance values were examined to highlight multivariate outliers. Mahalanobis distance values were calculated using SPSS 27. Multivariate outliers are Mahalanobis distance values that fell above a critical value on the Chi-Square distribution (df = 10, α = .001, critical value = 27.7). Examination of Mahalanobis distance values indicated there were no multivariate outliers present in the collected data.

Another crucial assumption to the mixed MANOVA analysis is univariate and multivariate normality. A Shapiro-Wilk test in conjunction with Q-Q plots were conducted with the standardized residuals to assess univariate normality. Two variables (CTAS-2 & Describing) were identified as significant normality violations. Alternatively, Q-Q plots for standardized residuals showed all included variables with data points along the 45-degree angle, suggesting univariate normality is supported. Mardia's multivariate normality was performed in R 4.0.3 (R Core Team, 2021) using the MVN package (Korkmaz et al., 2019). Results of Mardia's test indicated there were issues with multivariate skewness (p = .009), yet no reported problems with kurtosis suggesting the assumption of multivariate normality were violated. Prior research indicates MANOVA analyses are robust to non-normality when the sample size exceeds 40 (Seo et al., 1995). As a result of this sample exceeding this criterion, the decision was made to

recognize the violation of multivariate normality yet determine it as non-problematic in the present analyses.

Mixed MANOVA analyses also require the assumption of homogeneity of variance-covariance matrices. Box's M test of covariance was conducted to ensure equivalence between the matrices. The analysis result was non-significant, Box's M = 290.565, F(210, 16262.10) = .978, p = .58, indicating that the data met this assumption. Additionally, mixed MANOVA analyses require the assumption of linearity. The assumption suggests that there is a straight-line relationship between the associated dependent variables. Examination of matrix scatterplots uncovered no clear evidence of a curvilinear relationship, thus supporting this analysis's assumption.

While discriminant analysis, or planned contrasts, is the optimal strategy to explain specific group effects in the MANOVA analysis, there is a lack of supported follow-up analysis options for mixed MANOVA. Specifically, when the goal is to explore the interaction effects, no reasonable multivariate strategy for identifying contributions to the effect is endorsed. Therefore, this study conducted multiple planned *a priori* univariate follow-up analyses to further elucidate significant group differences within the mixed MANOVA analysis.

Mixed MANOVA Results

The mixed MANOVA analysis was conducted to determine whether there were simultaneous mean differences over time (Session 1 & Session 2) in measurements of trait and state mindfulness, anxiety, and test anxiety (SMS, FFMQ, STAI, & CTAS-2) based on intervention group assignment (Guided & Relaxing). An omnibus Wilk's Lambda was statistically non-significant for the main effect of intervention assignment, Wilks $\Lambda = .848$, $p < .26$, $F(9, 65) = 1.16$, $d = .05$. The results of the analysis indicated a statistically significant Wilk's

lambda main effect of differences between session 1 and 2, Wilks Λ = .586, p < .01, F (9, 65) = 4.54, d = .35. The omnibus Wilk's lambda was statistically non-significant for the interaction between session and group assignment, Wilks Λ = .795, p < .07, F(9, 65) = 1.65, d = .05 (See Table 4).

Table 5. Group Means

		Session 1		**Session 2**	
Variable	**Group**	M	Sd	M	Sd
SMS	Guided	2.23	.87	2.76	.73
	Relaxing	2.16	.84	2.35	.74
Observing	Guided	3.35	.70	3.35	.56
	Relaxing	3.26	.72	3.26	.76
Describing	Guided	3.13	.89	3.20	.78
	Relaxing	3.01	.71	3.05	.67
Awareness	Guided	2.76	.78	2.69	.80
	Relaxing	2.98	.76	2.76	.66
Nonjudging	Guided	3.05	1.09	2.89	1.11
	Relaxing	2.77	.79	2.76	.82
Nonreactivity	Guided	2.88	.62	2.91	.61
	Relaxing	3.03	.67	2.97	.63
STAI-T	Guided	2.38	.55	2.30	.58
	Relaxing	2.39	.53	2.30	.55
STAI-S	Guided	2.35	.55	1.84	.56
	Relaxing	2.25	.53	1.97	.58
CTAS-2	Guided	2.38	.88	2.29	.87
	Relaxing	2.42	.70	2.48	.78

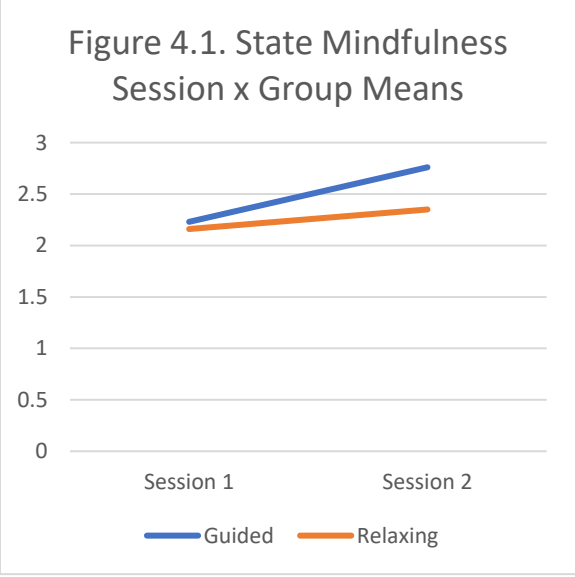
Note: n = 75 (38 Relaxing/37 Guided)

Univariate Post Hoc Analyses

Repeated Measures Factorial ANOVA requires three primary assumptions: independence, normality, and sphericity. The assumption of independence implies that participants are randomly assigned to only one group, thus ensuring that their responses will only be attributed to their group (Hahs-Vaughn, 2017). Verification requires the data and sampling plan to be examined, whereas participants were randomly assigned after recruitment from a traditional undergraduate subject pool, indicating that the assumption is met. Similar to the

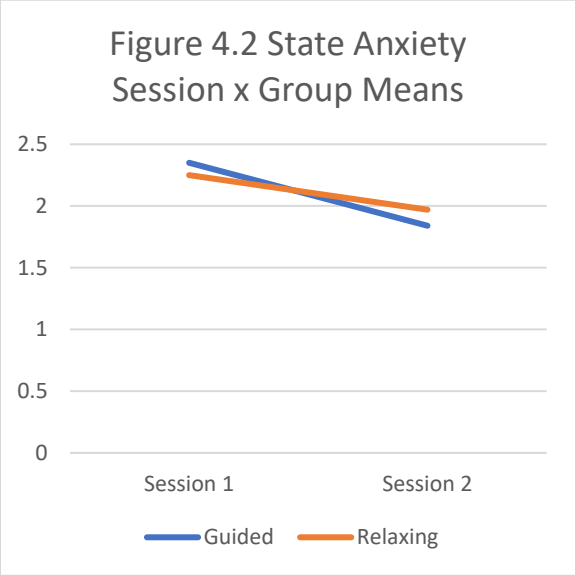
MANOVA, the normality violation from the CTAS variable violates the normality assumption. Due to the F-test's robustness to non-normality when used with a sufficient sample, the violation will not significantly impact the outcomes (Blanca et al., 2017). The assumption of sphericity is only accounted for when there are three or more levels to a group. In line with a Bonferroni correction to prevent Type I error, significance levels are made more stringent (p = .0125).

A repeated measures factorial analysis of variance was conducted on participants average state mindfulness (SMS) based upon the intervention group assignment (Relaxing, Guided) across two sessions. The main effect for group assignment was determined to be statistically non-significant, F(1, 74) = 2.64, p = .11, d = . 30. Notably, the within subjects main effect of session was revealed to be statistically significant, F(1, 74) = 13.57, p = .001, d = .45. The interaction between group assignment and session was determined to be statistically non-significant, F(1, 74) = 3.09, p = .08, d = .21 (See Figure 4.1).

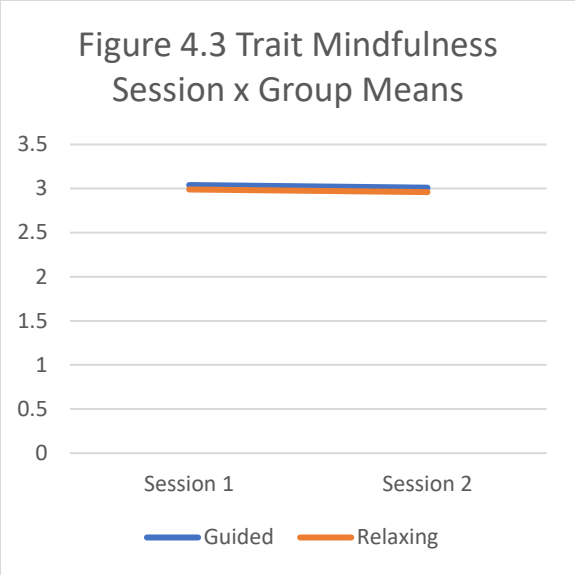


A repeated measures factorial analysis of variance was conducted on participants average state anxiety (STAI-S) based upon group assignment (Relaxing, Guided) over two sessions. The group assignment main effect was statistically non-significant, F(1, 74) = 0.152, p = .70, d = .06.

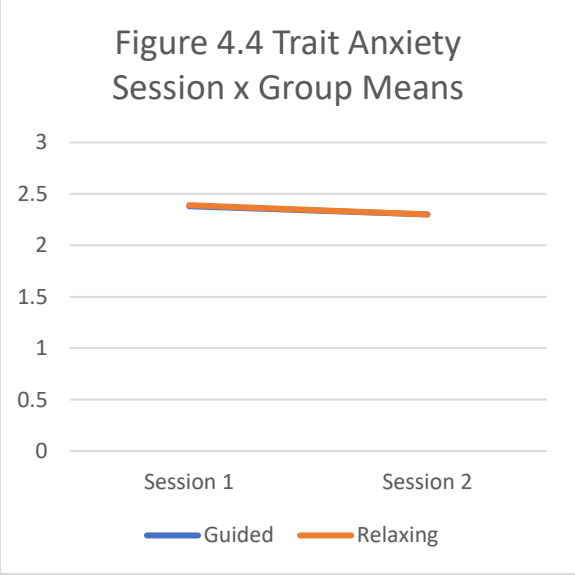
The main effect of session was revealed to be statistically significant, F(1, 74) = 31.15, p = .001, d = .67. The interaction between group assignment and session was determined to be statistically non-significant, F(1, 74) = 3.78, p = .056, d = .22 (See Figure 4.2).



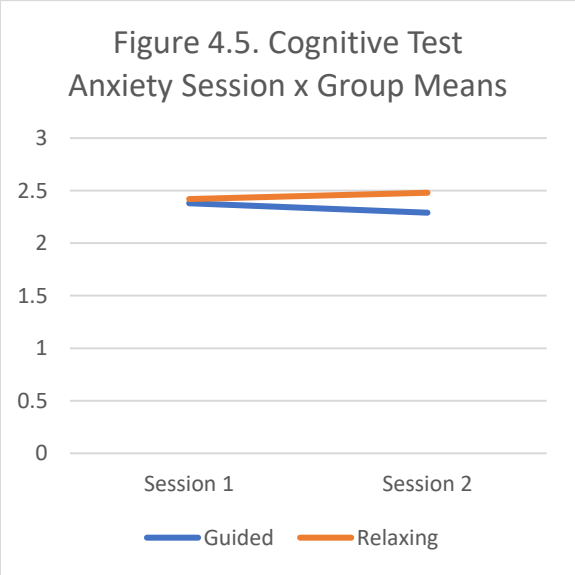
A repeated measures factorial analysis of variance was conducted on participants average Trait Mindfulness (FFMQ) based upon the intervention group assignment (Relaxing, Guided) over two sessions. The main effect for group assignment was determined to be statistically non-significant, F(1, 73) = .202, p = .66, d = .11. The within subjects main effect of session was revealed to be statistically non-significant, F(1, 73) = 1.51, p = .22, d = .06. The interaction between group assignment and session statistically non-significant, F(1, 73) = 0.08, p = .78, d = .00 (See Figure 4.3).



A repeated measures factorial analysis of variance was conducted on participants average Trait Anxiety (STAI-T) based upon the intervention group assignment (Relaxing, Guided) across two sessions. The main effect for group assignment was statistically non-significant, $F(1, 74) = .08$, $p = .78$, $d = .06$. The within subjects main effect of session determined as statistically significant with a small effect size, $F(1, 74) = 7.65$, $p = .007$, $d = .15$. The interaction between group assignment and session was determined to be statistically non-significant, $F(1, 74) = .02$, $p = .88$, $d = .00$ (See Figure 4.4).



A repeated measures factorial analysis of variance was conducted on participants average cognitive test anxiety (CTAS-2) based upon the intervention group assignment (Relaxing, Guided) between two sessions. The main effect for group assignment was statistically non-significant, $F(1, 74) = .57$, $p = .45$, $d = .16$. The within subjects main effect of session determined as statistically non-significant, $F(1, 74) = .01$, $p = .91$, $d = .01$. The interaction between group assignment and session was determined to be statistically non-significant, $F(1, 74) = 4.27$, $p = .04$, $d = .11$ (See Figure 4.5).



Assessing Predictors of Anxiety and Mindfulness

Multiple Regression Assumptions

The multiple linear regression analysis carries multiple assumptions that should be met before inferences are made upon the outcomes, including a linear relationship between the predictors and dependent variable, approximately normal distribution, independence of observations, and homoscedasticity of errors.

A primary assumption of multiple regression ensures that there is an independence of observations. To provide support for this assumption, a residual by predicted values scatterplot

needs to be assessed for a random array of points (Hahs-Vaughn, 2017). In both of the following multiple regression analyses, there is no presence of a pattern in the residuals supporting this assumption. Furthermore, a Durbin-Watson Autocorrelation test conducted alongside both multiple regression analyses support this assumption (Anxiety - DW = 1.84; Mindfulness – DW = 1.92).

The normality assumption states that the prediction errors are normally distributed and maintain a normal shape. Several methods exist to assess this, such as observing univariate statistics, a residuals Q-Q plot, or a Shapiro-Wilk analysis (Hahs-Vaughn, 2017). Univariate statistics (Skewness, Kurtosis, & Histogram distributions) were within acceptable bounds (+1 - -1) and a residuals Q-Q plot revealed that datapoints were mostly aligned on the 45-degree angle providing support for the assumption of normality being met. The Shapiro-Wilk analysis provides support for both multiple regressions with statistical non-significance (Anxiety - SW = .991, p = 54; Mindfulness - SW = .994, p = .65).

The assumption of homoscedasticity states that the distribution of residuals will maintain a consistent variance from the line of best fit (Hahs-Vaughn, 2017). The residual scatterplots associated with both multiple regression analyses provide support for the assumption of homoscedasticity being met.

The linearity assumption associated with the multiple regression analysis supposes a linear relationship between the independent variable values and the observed values for the dependent variable (Hahs-Vaughn, 2017). The assumption can be checked through a residuals plot, and violation would show the presence of a non-linear or curvilinear relationship. There was no observation of a curvilinear relationship in the residuals plot, thus supporting the assumption of linearity.

The final assumption for multiple regression analyses is the multicollinearity assumption. This assumption presumes that there is not a strong relationship between the predictors of the independent variable. The statistical method to detect multicollinearity violations is the variance inflation factor (VIF). To satisfy the assumption, VIF values need to remain < 10 (Hahs-Vaughn, 2016; Myers & Myers, 1990). In the trait mindfulness multiple regression, the inclusion of the trait anxiety measure (STAI-T) exceeded the acceptable VIF values and needed to be removed due to a strong relationship between the neuroticism personality trait and the trait anxiety measures. Post-removal, the VIF values associated with both analyses remained between 1.12 – 1.74, thus providing support for that assumption.

When conducting multiple regression analyses, multiple outcome statistics may interpret the relationships between predictors and dependent variables. For the purpose of this examination, adjusted R^2 will be employed because adjusted R^2 accounts for the number of independent variables and sample sizes providing a more accurate estimation (Hahs-Vaughn, 2016).

Multiple Regression Results

The first multiple linear regression model assigned trait mindfulness as the dependent variable, and the variables of state anxiety, extraversion, agreeableness, conscientiousness, neuroticism, and openness were one block of predictors. The trait anxiety variable was removed from this analysis due to multicollinearity issues. A significant proportion of the total variation in trait mindfulness (FFMQ) was predicted by neuroticism and state anxiety, $F(6,131) = 19.5$, $p = .001$, Adj. $R^2 = .45$ (See Table 5).

The second multiple linear regression analysis assigned trait anxiety as the dependent variable and state mindfulness, trait mindfulness, extraversion, agreeableness, conscientiousness,

neuroticism, and openness were one block of predictors. The analysis indicated that trait anxiety was reliably explained by neuroticism and trait mindfulness, $F(6,129) = 36.2$, $p = .001$, Adj. $R^2 = .65$.

Table 6. Multiple Regression Results

Model	*t*	β	*F*	*df*	Adj R^2
Trait Mindfulness			19.5*	6, 131	.45
State Anxiety	-4.09*	-.33			
Extraversion	.38	.03			
Agreeableness	.98	.07			
Conscientiousness	1.15	.09			
Neuroticism	-4.68*	-.37			
Openness	.45	.03			
Trait Anxiety			36.2*	7, 129	.65
State Mindfulness	1.09	.05			
Trait Mindfulness	-6.72*	-.45			
Extraversion	-1.51	-.09			
Agreeableness	-1.94	-.12			
Conscientiousness	-.07	-.01			
Neuroticism	5.84*	.39			
Openness	1.21	.05			

Note * - $p < .001$

Hierarchical Multiple Regression Results

After concluding the primary analyses, artifacts were identified within the multiple regression analyses prompting exploration of the data through a modified statistical approach. The multicolleniarity violation when introducing trait anxiety as a predictor and a significant variation in noted findings when compared to previous research prompted the addition of these ancillary analyses to assess the influence of mindfulness and anxiety on one another in the initially proposed models. Hierarchical multiple regression analyses were employed to determine if the staged introduction of predictors would provide insight to previous research exploring the relationships of Big Five personality variables with trait anxiety and trait mindfulness.

A two-stage hierarchical multiple regression assigned trait mindfulness as the dependent variable, and the variables of extraversion, agreeableness, conscientiousness, neuroticism, and openness were block one predictors with state anxiety added in the second block (recall that trait anxiety was removed due to multicollinearity). The block one regression model revealed that

trait mindfulness was predicted by conscientiousness and neuroticism, $F(5, 132) = 17.9$, $p = .001$, Adj. $R^2 = .38$. The addition of state anxiety to the regression model explained an additional 7% of the variation in trait mindfulness and this change was significant, $F(6,131) = 19.5$, $p = .001$, Adj. $R^2 = .45$ (See Table 6). The complete model only identified neuroticism and state anxiety as significant predictors of trait mindfulness, suggesting that the variance accounted for by conscientiousness in the first block was more durably explained by state anxiety.

The second two-stage hierarchical multiple regression assigned trait anxiety as the dependent variable, and the variables of extraversion, agreeableness, conscientiousness, neuroticism, and openness with state and trait mindfulness in the second block. The block one regression model revealed that trait anxiety was predicted by agreeableness and neuroticism, $F(5, 131) = 31.3$, $p = .001$, Adj. $R^2 = .53$. The addition of state and trait mindfulness to the regression model explained an additional 11% of the variation in trait anxiety and this change was significant, $F(7, 129) = 36.2$, $p = .001$, Adj. $R^2 = .65$ (See Table 6). The complete model only identified neuroticism and trait mindfulness as significant predictors of trait anxiety.

Table 7. Hierarchical Multiple Regression Results

Model		*t*	β	*F*	*df*	Adj R^2	ΔR^2
Trait Mindfulness							
Block 1				17.9*	5, 132	.38	.38
	Extraversion	0.47	0.02				
	Agreeableness	1.07	0.06				
	Conscientiousness	2.09*	0.11				
	Neuroticism	-7.53*	-0.29				
	Openness	0.56	0.03				
Block 2				19.5*	6, 131	.45	.07
	Extraversion	0.38	0.01				
	Agreeableness	0.98	0.05				
	Conscientiousness	1.15	0.06				
	Neuroticism	-4.68*	-0.20				
	Openness	0.45	0.02				
	State Anxiety	-4.09*	-0.26				
Trait Anxiety							
Block 1				31.3*	5, 131	.53	.53
	Extraversion	-1.57	-0.07				
	Agreeableness	-2.20*	-0.14				
	Conscientiousness	-0.89	-0.05				
	Neuroticism	10.10*	0.43				
	Openness	1.02	0.06				
Block 2				36.2*	7, 129	.65	.11
	Extraversion	-1.51	-0.06				
	Agreeableness	-1.94	-0.11				
	Conscientiousness	0.08	0.01				
	Neuroticism	5.84*	0.26				
	Openness	1.21	0.06				
	State Mindfulness	0.91	0.03				
	Trait Mindfulness	-6.72*	-0.56				

Note * - $p < .001$

Chapter 5: Discussion

Anxiety, and the specific subcomponent of test anxiety, afflicts over a third of the academic population (Gregor, 2005; von der Embse et al., 2018). The presence of anxiety generates detrimental cognitive and physiological intrusions that interfere with daily tasks in a wide variety of situation-specific arenas (APA, 2013). Fortunately, multiple interventions have been developed to reduce the severity of the cognitive and physiological manifestations that result from academic anxieties (Segool et al., 2014). Mindfulness practitioners and researchers have made advancements in demonstrating the effectiveness of traditional mindfulness interventions in academic settings (Kang et al., 2018; Shahidi et al., 2017; Taylor et al, 2014). Contemporary literature provides evidence supporting the implementation of digital mindfulness programs in the reduction of anxiety symptomology as well (Bonamo et al., 2015; Cho et al., 2016; Mrazek et al., 2012; Sampl, 2017). Furthermore, a growing trend in literature highlights the effectiveness of brief mindfulness interventions (one session, < 1 Hour) in reducing anxiety, test anxiety, and increasing mindfulness (Bonamo et al., 2015; Carsley & Heath, 2018; Mahmood et al., 2016). The present study adds to the existing literature by investigating the effectiveness of a mindfulness intervention for university students that is both brief and delivered in a digital format.

As predicted, the findings of the current examination illustrate the efficacy of a brief digital mindfulness intervention in reducing state mindfulness and state anxiety in university students. However, the results did not reveal a differential benefit for the guided meditation condition as compared to their peers assigned to the relaxing condition. The mindfulness intervention conditions were found to have no measured impact on trait mindfulness or trait anxiety levels. This confirmed initial hypotheses and supports the validity of the primary

findings given the durability of trait measures, and only a long-term intervention effort should have demonstrable impact on those stable factors. Finally, the results demonstrated no significant change in levels of reported cognitive test anxiety over time or between the two mindfulness experience conditions. While there was some evidence suggesting that cognitive test anxiety may be impacted in this intervention (particularly in the guided meditation experience that included specific statements focused on releasing perceived threats of tests; Cho et al., 2016; Mahmood et al., 2016), the stability of the cognitive test anxiety values over the two administration sessions is consistent with the literature asserting that the cognitive component of test anxiety is predominantly a trait-like construct (Hembree, 1988; Zohar, 1998).

The regression models used to determine predictor variables for trait mindfulness and trait anxiety conformed to primary representations of the constructs demonstrated in prior research. Specifically, the neuroticism personality trait represented in the Big Five personality trait was instrumental in predicting levels of both trait mindfulness and trait anxiety. In the trait anxiety prediction, high levels of neuroticism along with trait mindfulness were instrumental in explaining individual variation in TA. Conversely, low levels of neuroticism along with trait mindfulness were the most useful variables in explaining levels of TM. Ancillary hierarchical regression analyses added the trait constructs in a secondary block, identifying openness and conscientious as significant predictors of trait mindfulness and trait anxiety. These findings remain consistent with traditional mindfulness intervention literature, despite the current examinations focus on brief digital mindfulness interventions (Cho et al., 2016; Hjeltnes et al., 2015; Sampl, 2017; Loathes et al., 2019).

Brief Digital Mindfulness Intervention Effectiveness

While most of the research in mindfulness intervention practice has focused on the utilization of traditional programs (generally 6 to 8-weeks in duration) to observe differences, there is a growing area of research demonstrating the ability of mindfulness-based interventions to have significant impact in singular 15-minutes interventions (Carsley & Heath, 2018; Gazella, 2005; Kabat-Zinn, 1982; Kang et al., 2018; Kiken & Shook, 2011; Weger et al., 2011). Research has also focused on the effectiveness of digital mindfulness interventions, revealing significant changes to state mindfulness in a digital-only mindfulness intervention (Mahmood et al., 2016).

The current examination sought to expand upon the literature by attempting a mindfulness-based intervention that was both brief and digital, focused upon the undergraduate population. Participants completed self-report measures at two sessions (three days apart) designed to assess trait and state components of anxiety, test anxiety, and mindfulness. State mindfulness and anxiety are situational variable dependent upon context and setting (Tempel & Neumann, 2014). Therefore, it was hypothesized the influence of a brief digital mindfulness should impact the fluid and dynamic elements of mindfulness and anxiety, while leaving the dispositional elements unchanged.

Brief Mindfulness Interventions and State Measures of Anxiety and Mindfulness

The results identified perceptions of state anxiety and mindfulness were influenced by the designed mindfulness intervention, yet the trait measures remained consistent. These results appear to reflect findings from prior literature designed to increase state mindfulness in individuals within a single session (Bazzano et al., 2018; Bonamo et al., 2015; Bravo et al., 2018; Daniel, 2014; Lever Taylor et al., 2014; Mahmood et al., 2016; Weger et al., 2011). Weger et al. (2011) revealed that a brief mindfulness intervention (5 Minutes) significantly increased state

mindfulness compared to a control group. In addition, cognitive interference via stereotype threat was significantly reduced during the single session as well (Weger et al., 2011). Alberts and Theweissen (2011) presented results showing that an in-person guided audio breathing session (12 Minutes) improved state mindfulness while also improving word recall task performance. Kiken and Shook (2011) conducted an in-person brief mindfulness induction (15 minutes) to reduce negativity bias in students. Results revealed brief mindfulness interventions were effective in increasing state mindfulness, thus allowing for more attentional resource availability (Kiken & Shook, 2011). Watier and Dubois (2016) conducted a brief mindfulness intervention to assess memory and executive attention and uncovered significant changes to state mindfulness post ten-minute mindfulness meditation exercise in-person.

The current examination reflects previous research (in-person and digital), suggesting that mindfulness interventions significantly increase state mindfulness. The primary deviation from the literature is in the success of the audio guided meditation intervention utilized within Alberts and Theweissen (2011). While the current examination's intervention was successful in the reduction of targeted state measurements across sessions, the guided meditation condition was not significantly more effective than the relaxing video condition in reducing state anxiety or increasing state mindfulness. Side-by-side comparison of group means identified that the guided meditation intervention did increase state mindfulness and decrease state anxiety more than the relaxation group, but not enough for significant statistical interaction (See Figures 4-1 & 4-2). A potential explanation for these deviation from contemporary literature is the difference in location. Previous research delivered guided meditation interventions in-person, whereas the current study conducted all interventions digitally (Alberts & Thewissen, 2011; Bonamo et al., 2015; Kiken & Shook, 2011). Additionally, Mrazek et al. (2011) revealed that a guided breathing

audio file was significantly more effective than a passive relaxation activity. These differences suggest that the delivery of a guided meditation intervention to improve state mindfulness and reduce state anxiety may be more effective in a physical environment.

Previous literature suggests that these non-significant trends favoring the guided meditation intervention could reach a critical level leading to a measurable benefit by increasing the number of sessions (Daniel, 2014). Increases in the session count (1 session – 6 weeks) for the guided meditation intervention has been seen in literature to not only increase mindfulness but also decrease anxiety, as compared to just passively relaxing for the same duration (Kang et al., 2018; Shahidi et al., 2017). Conversely, the argument to increase the duration of a single digital intervention session has been refuted in previous literature (Bonamo et al., 2015). Bonamo et al. (2015) revealed no significant difference in state mindfulness benefits between a 20- and 45-minute body scan meditation, indicating that increasing the magnitude of a single session may only serve to make participants bored or restless.

Brief Mindfulness Interventions and Trait Measures of Anxiety and Mindfulness

Brief mindfulness interventions appear to boost state mindfulness in the immediate future, with multiple mindfulness intervention varieties significantly impacting the state measurement of mindfulness while trait mindfulness remains stable. This finding is consistent with Watier and Dubois (2016) who conducted a 10-minute brief mindfulness intervention resulting in trait mindfulness remaining non-significantly different compared to the control condition. Extended longitudinal studies show trait mindfulness to be malleable with a variety of mindfulness exercises as well (Kang et al., 2018; Shahidi et al., 2017; Teasdale et al., 1995).

These results provide three potential directions for interpretation. The lack of variation in trait mindfulness across sessions might be indicative of a ceiling effect in individuals potential

trait mindfulness (Carsley & Heath, 2019). The trait mindfulness scale utilized in this study (FFMQ) may also not be sensitive enough to detect differences across the two sessions in either total trait mindfulness nor the specific subscales within (Watier & Dubois, 2016). While the previous interpretations concern potential measurement issues, an individual's trait anxiety and mindfulness should remain stable as they are measures of dispositional traits. A single session mindfulness intervention should not be expected to significantly impact core individual traits. Instead, the continuous gradual improvement of an individual's trait mindfulness is seen through consistent and repeated mindfulness practice. Previous research consistently finds trait mindfulness differences in traditional guided meditation intervention programs, suggesting the targeted repetitious designs will make more profound long-term alterations to trait constructs (Lever Taylor et al., 2014; Shahidi et al., 2017; Teasdale et al., 2000).

Brief Mindfulness Interventions and Test Anxiety

Results showed non-significant differences in test anxiety scores regardless of session or condition. Despite this, the mean difference trends showed the guided meditation leading to non-significant declines in cognitive test anxiety, while the relaxation group maintained their test anxiety levels. Previous research with brief mindfulness interventions effectiveness suggested that test anxiety would be positively influenced, despite it being largely identified as a trait construct (Carsley & Heath, 2018; Cho et al. 2016; Sampl et al., 2017). For example, Carsley and Heath (2019) employed a brief mandala coloring intervention task to significantly reduce test anxiety, whereas this examination used a guided meditation intervention to influence test anxiety.

The differences in these prior findings and the current study can be accounted for by two potential explanations. In the current study, the CTAS-2 was utilized to assess test anxiety. The

CTAS-2 is a unidimensional instrument designed to zero in specifically on the cognitive component of test anxiety (Cassady & Finch, 2015; Thomas et al., 2017). Conversely, Carsley & Heath (2018) utilized the State Trait Anxiety Inventory – State Children version (STAI-SC). Similar to the instrument utilized in this study, their version only captured the state component of general anxiety as a proxy for a test anxiety measure, not to mention the STAI is a multidimensional instrument for anxiety assessment (Spielberger, 1983). In the Cho et al. (2016) study, the intervention was a mindful breathing exercise with measurements taking place a week apart instead of within a single session. The instrument utilized to assess significant test anxiety differences across sessions was the Revised Test Anxiety Scale, a multidimensional scale capturing both the worry (cognitive) and emotionality (physiological) components of test anxiety (Benson & El-Zahhar, 1994). The variation of results compared to Benson and El-Zahhar may be attributed to the use of a total anxiety score formed by the compilation of both the trait-like aspect of the worry component and the state-like aspect of the emotionality component. Collectively, multidimensional nature of measures used in prior studies (STAI & RTA) indicates that significant differences between previous findings and the current examination may be attributed to capturing the oft malleable emotionality test anxiety component (Hembree, 1988). The current examination revealed similar differences in state anxiety (STAI-S) as reported in previous literature. The STAI-S is not a direct measure of test anxiety, but misutilization of the outcomes could lead the current interpretation of results to similar outcomes.

Therefore, a final supposition for the lack of significance in test anxiety compared to previous research could be the lack of a measurement targeting the physiological component of test anxiety. Therefore, the changes observed in previous literature potentially indicate that mindfulness practices target the physiological components of test anxiety through the focus on

rhythmic breathing and allowing intrusive thought to pass by instead of attending to them generating anxiety reactions (Cho et al., 2016).

Predictors of Trait Mindfulness and Trait Anxiety

Big Five Personality Traits Predicting Trait Anxiety

The multiple regression analysis examining the predictors of trait anxiety highlighted neuroticism as the only significant Big Five personality trait predicting anxiety in individuals. Additionally, level of trait mindfulness was instrumental in predicting trait anxiety such that those higher in mindfulness reported lower levels of anxiety. Previous literature has repeatedly demonstrated that neuroticism from the Five Factor Personality Model is a durable predictor for anxiety, however prior research also frequently identifies openness to experience and conscientiousness as negatively related to anxiety (Giluk, 2009; Thomas & Cassady, 2019; von der Embse et al., 2018). An additional hierarchical regression was explored after the primary research analyses were completed to determine if isolating the prediction model on only the traditional Big Five factors in the initial block would simulate previous findings in literature. Those prior studies have suggested that a negative relationship between test anxiety and openness may indicate that individuals high in the openness trait have greater risk tolerance (Kumaran & Kadhiravan, 2015; Thomas & Cassady, 2019).

As mentioned, the primary multiple regression analysis did not detect that openness provided a meaningful contribution to predicting trait anxiety. However, the hierarchical regression revealed that maintaining the focus on the big five personality trait in a block separate from the mindfulness measures aligned the current findings with previous literature (Giluk, 2009; Thomas & Cassady, 2019; von der Embse et al., 2018). The additional analyses demonstrated that the trait mindfulness measure assumed all the predictive power that the

openness personality trait has normally possess in previous literature. These results reaffirm the assumption that openness to experience is a critical component to the mindfulness construct and that improvements to trait mindfulness should allow for less maladaptive approaches to anxiety inducing scenarios.

Big Five Personality Traits Predicting Mindfulness

While the initial analysis plan was designed to assess all variables in a single block format, research outcomes from the initial analysis suggested the hierarchical regression design would be more beneficial in providing appropriate information on the prediction of trait mindfulness. The findings from the hierarchical analysis mirrored prior findings that suggest trait mindfulness is predicted by neuroticism and conscientiousness in the first block. Giluk (2009) meta-analysis identified neuroticism and conscientiousness as common predictors in previous literature, in addition to openness to experience yet with a smaller correlation. The second block's addition of state anxiety as a possible predictor then reduced the Big Five personality traits influence, similar to the initial multiple regression analysis. Both statistical approaches significantly identified neuroticism as significantly predicting trait mindfulness, but the absence of anxiety measurements from the first block revealed conscientiousness as a significant predictor of trait mindfulness as well.

Similar to the trait anxiety model, when using only Big Five personality traits to predict mindfulness, the results were consistent with previous research. However, in the second block, when State Anxiety was added as a possible predictor, the Big Five representation dropped off in influence. Naturally, this is most likely due to state anxiety accounting for the same variance initially attributed to the Big Five. Collectively, the results indicate that being lower in anxiety and neuroticism is more instrumental in predicting mindfulness than other traditionally valued

factors from the Big Five (e.g., Conscientiousness & Openness to Experience)). This is a curious result because prominent models identify openness to experiences and self-discipline as core components to the theoretical understanding of mindfulness (Grabovac et al., 2011; Jankowski & Holas, 2014; Langer, 1997).

An explanation for this apparent deviation from prior findings may be based on the differential representations of core definitions of the constructs. The openness construct within mindfulness models may also map onto big five personality traits differently than initially expected. While personality and mindfulness interpretations of openness both address curiosity and present-centered thinking, the personality measurement of openness highlights inventive thinking and artistic interests (Bishop et al., 2004; O. P. John & Srivastava, 1999). Previous literature has conducted similar analyses with differential results, thus indicating that difference may be present from the state or trait measurements of mindfulness (Giluk, 2009).

Interconnected Relationship between Anxiety and Mindfulness

While the big five personality trait model is not irrefutable as an accurate representation of individual personality, the model allows for explainable differentiations between surface level individual difference domains (Oliver P. John & Srivastava, 1999). In the present examination of personality traits as core predictors of trait mindfulness and trait anxiety, results emulated previous literature only when trait constructs were removed. The hierarchical regression analyses revealed that trait anxiety was predicted by agreeableness and neuroticism and trait mindfulness was predicted by conscientiousness in the first block, respectively. In this examination, the internal reliability for openness and agreeableness did not function as well as the other subscales presenting a potential limitation to the results interpretation. However, the introduction of trait

anxiety and trait mindfulness significantly increased the variance explained, while removing the significant predictive value of non-neuroticism personality traits.

The results from the hierarchical multiple regressions present an interesting theoretical topic of discussion. Regression models revealed that anxiety and mindfulness significantly predict one another at the expense of the "established" personality variables. The relationship explicated here indicates that the positive psychology mindfulness construct may serve as the antithesis to the anxiety construct. Mindfulness is broadly defined as deliberate, heightened awareness to present moment experiences (internal & external; Brown & Ryan, 2003; Kabat-Zinn, 2003; Soysa & Wilcomb, 2015). General anxiety disorder is characterized by excessive, unruly intrusive thought patterns, often directed at past or future events (American Psychiatric Association, 2013). Operationally, the constructs oppose one another as "high" mindfulness individuals are concerned with only the present moment, ignoring broad interference from maladaptive or distracting events or feelings (Soysa & Wilcomb, 2015). Additionally, the only personality trait consistently relating the trait constructs is neuroticism. Evidence collectively suggests that anxiety and mindfulness are represented upon a singular axis, potentially measured by neuroticism exhibited by individuals. Neuroticism's relationship with anxiety generally only refers to the deficits model, or how much of a detriment element you have from none and upward (Tobias, 1985). The continuum approach proposed here enhances this interpretation by introducing the concept of making improvements to mindfulness in addition to reducing anxiety (or neuroticism).

The potential continuum relationship between the mindfulness and anxiety variables adds explanatory strength as to why targeted mindfulness interventions are effective in anxiety reductions. Meta-analyses consistently have identified mindfulness interventions as effective in

the reduction of anxiety in students (Ergene, 2003; Hembree, 1988; Soares & Woods, 2020; von der Embse et al., 2018). Furthermore, an interrelated conceptualization of these constructs provides future efficacious intervention-based research designs explanatory power as to why mindfulness interventions are effective in the reduction of anxiety-based symptomology.

Limitations and Future Directions

The current study contained limitations that should be acknowledged to mitigate potential implications they hold over the inference of the results. During the development of the research design and data collection phase of this study, the global community was experiencing the COVID-19 pandemic. As a result, multiple potential impacts from the influences of extended lockdowns, among other elements, may have impacted the outcomes reported here (Jia et al., 2020). Commonly, this is referred to as a history effect, or a threat to internal validity that identifies events outside an experiment influencing a variable of interest (Martella et al., 2013). For example, general anxiety generated by participants unease and increased test anxiety from learning in predominantly digital environments may have influenced participants' levels of anxiety or mindfulness in general.

Another consequence of the pandemic was the requirement to engage in a purely digital delivery method for both the intervention and data collection. This introduced a litany of unavoidable confounding variables that assumedly generated treatment fidelity concerns between participants. Examples of these variations between participants include different environments the meditation was conducted, different devices used for digital intervention, unavoidable interruptions in the home environment, and unstable internet access and quality. While detrimental effects are possible, the intervention being conducted in environments where it would be utilized in a real-world context accommodates greater ecological validity. Additionally,

previous research demonstrating successful outcomes with mindfulness interventions in their personal environments as well as studies demonstrating no difference in intervention effectiveness between physical and digital environments (Lothes et al., 2019; Mahmood et al., 2016).

A final limitation to this study is the potential lack of generalizability to the broader population. Most of the sample were educated, Caucasian, and female (66%). With limited representation from male students, other ethnic minority groups, or lower academically performing student, this study lacks broad representation or generalizability. While, the sample is representative of the population, future research can reduce the impact of this limitation by exploring alternate sampling options that aim to equally draw various ethnic, ability, and gender groups. Additionally, the inherent focus on anxiety reduces the generalizability from the adults population to traditional college student populations.

The next steps the brief digital mindfulness research aim to explore is to attempt to replicate the study and design but in a “live” classroom environment. Utilizing this digital tool, with students in association with the challenges present in coursework (prior to a test) allows for more avenues to explore these questions. Future research can explore the threshold for repeated mindfulness interventions begin to affect individuals’ trait mindfulness and trait anxiety. Furthermore, increased mindfulness sessions allow for participant introduction to a variety of brief mindfulness interventions. This approach permits the analysis of critical elements within mindfulness practices to positively influence individual trait anxiety. Multiple classes can be compared to have a true control group, and potentially add more variety to mindfulness practices that are better suited to the physical classroom environment.

Lastly, seeing as test anxiety is not a uniform experience, identification of anxiety profiles in conjunction with dispositional mindfulness elements spotlights differential treatment needs for individuals (Zeidner, 1998). Results from this research path allow for mindfulness-based intervention model development focused on multidimensional test anxiety assessment. Identification of complex mindfulness-anxiety relationship profiles will connect participants to mindfulness interventions suited to their specific presentation of test anxiety. Furthermore, identification of anxiety profiles allows for greater exploration into the notion of a mindfulness-anxiety continuum and the implications this relationship may have for mindfulness-based intervention development.

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Apendicies

Appendix A: Mindfulness Meditation Intervention Script

Introduction

Hello, welcome and thank you for taking time to participate in this study. Before beginning the exercise, let's take a moment to highlight the objectives of mindfulness practices overall. Mindfulness practice is a method to encourage individuals to adopt a present-centered approach to their everyday lives using purposeful attention to the present moment. This approach promotes compassion and acceptance while encouraging individuals to refrain from ruminating on past or future events and removing judgement.

Test and exam anxiety can be problematic for students. Worrying and stress interfere with studying and make it difficult to do your best on a project, test or quiz. Some people get so nervous that they get sick before exams. Exam anxiety can make it really challenging to getting good grades. This guided imagery exercise can be a useful tool

In this guided meditation, you will be guided through a series of brief exercises to reduce tension and anxiety. Prior to beginning this brief exercise, it is important to arrange yourself in a quiet comfortable environment where you will not be interrupted or distracted for the next ten minutes. Additionally, headphones are recommended. Finally, make yourself as comfortable as possible.

Breathing exercise

Begin by becoming very relaxed. Make yourself comfortable, finding a relaxed position in an environment free of distractions.
Start to relax your body, taking a deep breath in.... and out.
Breathe in to the count of four, hold for the count of 3, and breathe out to the count of 5. It goes like this:
Breathe in...2....3....4..... hold...2...3....exhale...2....3....4....5...
Breathe in...2....3....4..... hold...2...3....exhale...2....3....4....5...
Continue to breathe at this slow pace.
While you are breathing slowly, I'll direct your breathing awareness to different stages of the breath. Focus all of your attention on each stage I mention.
First, notice the breath as it enters your nose. Notice each time you breathe in, the way the breath feels on your nostrils.
Feel the breath as it passes through your nasal passages, and down behind your throat.
Where does the air go next? Feel each time you inhale, the breath passing down your windpipe.
Feel the breath going down.....
Feel the breath going down....
Notice where the air enters your lungs. Allow your breathing awareness to deepen the feeling of relaxation you are experiencing.
Feel the air expand your lungs with each in breath.
Feel your lungs expand... and relax.... expand.... and relax..... expand.... and relax.....
Now notice the exhalation phase of breathing. Observe as the air leaves your lungs and begins to travel upward. Focus your attention on that moment of each breath.
Now turn your attention to the breath traveling up and out, through your mouth. Feel the breath in your throat, your mouth, and across your lips.

Notice each breath as a whole now. See how the breaths flow like waves. Fist in.... and then a pause.... and out.... and then a pause.... Notice the pauses, these rests between breaths.
Now as you relax... you can count your breaths as they continue to flow gently. Count 10 breaths.

Body Scan

Now concentrate on your muscles. You may find that you are holding tension in your muscles. Pay particular attention to your shoulders, hands, and jaw.
Consciously lower your shoulders. Let your shoulders relax and allow the muscles to loosen. This act of relaxing your shoulders allows you to become calm because it places your body in a relaxed, easy position instead of a tense one.
Notice your hands, and let your hands be open, loose, and relaxed. Let your arms rest by your sides, letting go of all tension and just relaxing. You are learning how to relax under pressure.
Focus on your jaw. Allow your jaw to rest loosely, so your teeth are not touching. Let your mouth be loose and relaxed.
Mentally scan your body now, noticing any areas that are tense. When you notice tension, concentrate on relaxing that area. Allow your muscles to give up the tension they have been holding. Allow your body to relax. You are learning how to relax under pressure.
Focus on your breathing again...noticing...relaxing. Count each breath again if you like, breathing in to the count of four...holding for a count of three...and breathing out to the count of five.
(pause)
Now you are feeling calm and relaxed. Your whole body feels relaxed and heavy.

Visualization

Begin to visualize now the process of preparation for writing an exam. The first stage is motivation. Imagine how it would feel to be filled with motivation and drive, feeling compelled to study and write a test.
Fully imagine this feeling, and allow yourself to experience it completely. Feel motivation.
(pause)
You are so eager to write an exam.
Imagine now the preparation leading up to writing a test. Picture yourself studying... interested, motivated, eager. Enjoying the process of assimilating new information. You are confident and capable. See yourself studying, remembering the material, and feeling energized by this process.
See yourself studying several times, reading, writing, speaking... reviewing the information you need and committing it to memory.
(pause)
Now see yourself in your mind's eye... you have studied and are prepared for the exam. You are feeling a bit excited to write a test and share your knowledge.... but at the same time you are feeling calm and confident about the prospects of writing a test.
Imagine yourself during the examination. See how easy it is to recall the information you studied. Picture yourself confidently writing an exam, easily drawing upon your knowledge, answering every question, and knowing you have it right.

Some of the questions are easy, and you answer them quickly. Some questions are difficult, requiring intense thought. You were expecting this, and you are prepared. Imagine yourself as you write an exam, taking a moment to breathe deeply, slowly, calmly.... feeling your body relax and allowing your mind to become calm. In this state of calm, you are able to focus... and you answer the difficult questions thoughtfully. You experience mental clarity and concentration.

Take a few moments now to imagine the process of writing a test, feeling calm and confident, and seeing yourself answering questions successfully.

(pause)

Picture now, that you have finished the exam. See yourself feeling confident and gratified, though you have not yet recieved the results. You are feeling proud of yourself for your accomplishments of studying and writing an exam. You feel calm and confident while you wait for the exam results. You may find out soon how you did, or may have to wait.

Imagine getting the exam results. Feeling confident and excited.... and seeing the results: you passed! You receive an excellent grade, exactly what you were hoping for. This feeling of success and accomplishment is so wonderful, you want to write another exam just to experience it all again.

Enjoy the feelings of success.

(pause)

Take a moment to reflect upon the process of writing an exam - motivation, preparation, writing the exam, and finding out the results. Reflect upon this process feeling calm and interested.

(pause)

Now concentrate on your thoughts. Imagine each affirmation that follows, and believe each one to be true. You may want to repeat each phrase silently in your mind. You are learning how to relax under pressure.

I am calm.
I am relaxed.
I know how to relax easily.
I relax whenever I want to.
I handle situations with ease.
I am prepared.
I am focused.
I am strong.
I am confident.
I am so deeply relaxed.
I am so calm and serene.
I concentrate easily on the task at hand.
I easily relax under pressure.
I easily relax under pressure.
I feel calm and relax under pressure.
I am capable.
I am intelligent.
I am worthwhile.
I am skilled.

I am relaxed.
I am relaxed.
(Pause)
Every time you are under pressure, remember to do the three relaxation techniques you have just practiced:
Calm breathing.
Relax your muscles.
Calm your thoughts.
You can relax any time you need to, and the relaxation will help you to concentrate and keep your brain functioning at its best.
The slightest feeling of nervousness causes you to relax.
You can relax every day, in every situation.
Go through the relaxation exercises as many times as you need to in preparation for high pressure situations. When you relax, these situations can feel much less stressful.
Breathe deeply. Relax your muscles. Calm your thoughts.
(Pause)
Now you have completed this relaxation exercise. You can relax again any time you need to, and will experience the most benefit if you practice relaxing every day.
For now, it's time to return to the day head. Slowly reawaken your mind and body, becoming alert and awake while remaining relaxed and calm.
Open your eyes, and look around. Stretch if you want to. Sit quietly for a few moments as you wake up completely.
When you are fully alert you can resume your usual activities, feeling calm and refreshed.

Appendix B: Five Facet Mindfulness Questionnaire

Please rate each of the following statements using the scale provided. Select the option that best describes your own opinion of what is generally true for you.

1 – Never or Very Rarely True
2 – Rarely True
3 – Sometimes True
4 – Often True
5 – Very Often or Always True

1. When I'm walking, I deliberately notice the sensations of my body moving.
2. I'm good at finding words to describe my feelings.
3. I criticize myself for having irrational or inappropriate emotions.
4. I perceive my feelings and emotions without having to react to them.
5. When I do things, my mind wanders off and I'm easily distracted.
6. When I take a shower or bath, I stay alert to the sensations of water on my body.
7. I can easily put my beliefs, opinions, and expectations into words.
8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
9. I watch my feelings without getting lost in them.
10. I tell myself I shouldn't be feeling the way I'm feeling.
11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
12. It's hard for me to find the words to describe what I'm thinking.
13. I am easily distracted.
14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
15. I pay attention to sensations, such as the wind in my hair or sun on my face.
16. I have trouble thinking of the right words to express how I feel about things
17. I make judgments about whether my thoughts are good or bad.
18. I find it difficult to stay focused on what's happening in the present.
19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
21. In difficult situations, I can pause without immediately reacting.
22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.
23. It seems I am "running on automatic" without much awareness of what I'm doing.
24. When I have distressing thoughts or images, I feel calm soon after.
25. I tell myself that I shouldn't be thinking the way I'm thinking.
26. I notice the smells and aromas of things.
27. Even when I'm feeling terribly upset, I can find a way to put it into words.
28. I rush through activities without being really attentive to them.
29. When I have distressing thoughts or images I am able just to notice them without reacting.

30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.
31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.
32. My natural tendency is to put my experiences into words.
33. When I have distressing thoughts or images, I just notice them and let them go.
34. I do jobs or tasks automatically without being aware of what I'm doing.
35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.
36. I pay attention to how my emotions affect my thoughts and behavior.
37. I can usually describe how I feel at the moment in considerable detail.
38. I find myself doing things without paying attention.
39. I disapprove of myself when I have irrational ideas.

(Baer et al., 2006)

Appendix C: State Mindfulness Scale

Below is a list of statements. Please use the rating scale to indicate how well each statement describes your experiences in the past 15 minutes

Not at All (0) – 1 – 2 – 3 – Very Well (4)

1. I was aware of different emotions that arose in me
2. I tried to pay attention to pleasant and unpleasant sensations.
3. I found some of my experiences interesting
4. I noticed many small details of my experience
5. I felt aware of what was happening inside of me
6. I noticed pleasant and unpleasant emotions
7. I actively explored my experience in the moment
8. I clearly physically felt what was going on in my body
9. I changed my body posture and paid attention to the physical process of moving
10. I felt that I was experiencing the present moment fully
11. I noticed pleasant and unpleasant thoughts
12. I noticed emotions come and go
13. I noticed various sensations caused by my surroundings (e.g., heat, coolness, the wind on my face)
14. I noticed physical sensations come and go
15. I had moments when I felt alert and aware
16. I felt closely connected to the present moment
17. I noticed thoughts come and go
18. I felt in contact with my body
19. I was aware of what was going on in my mind
20. It was interesting to see the patterns of my thinking
21. I noticed some pleasant and unpleasant physical sensations

(Tanay & Bernstein, 2013)

Appendix D: State Trait Anxiety Inventory

Access to specific items are avaiable via Mindgarden - https://www.mindgarden.com/145-state-trait-anxiety-inventory-for-adults

Appendix E: Big Five Inventory

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please select a number next to each statement to indicate the extent to which you agree or disagree with that statement.

1 – Disagree Strongly
2 – Disagree a Little
3 – Neither Agree nor Disagree
4 – Agrees a Little
5 – Agree Strongly

1. Is talkative
2. Tends to find fault with others
3. Does a thorough job
4. Is depressed, blue
5. Is original, comes up with new ideas
6. Is reserved
7. Is helpful and unselfish with others
8. Can be somewhat careless
9. Is relaxed, handles stress well
10. Is curious about many different things
11. Is full of energy
12. Starts quarrels with others
13. Is a reliable worker
14. Can be tense
15. Is ingenious, a deep thinker
16. Generates a lot of enthusiasm
17. Has a forgiving nature
18. Tends to be disorganized
19. Worries a lot
20. Has an active imagination
21. Tends to be quiet
22. Is generally trusting
23. Tends to be lazy
24. Is emotionally stable, not easily upset
25. Is inventive
26. Has an assertive personality
27. Can be cold and aloof
28. Perseveres until the task is finished
29. Can be moody
30. Values artistic, aesthetic experiences
31. Is sometimes shy, inhibited
32. Is considerate and kind to almost everyone
33. Does things efficiently
34. Remains calm in tense situations

35. Prefers work that is routine
36. Is outgoing, sociable
37. Is sometimes rude to others
38. Makes plans and follows through with them
39. Gets nervous easily
40. Likes to reflect, play with ideas
41. Has few artistic interests
42. Likes to cooperate with others
43. Is easily distracted
44. Is sophisticated in art, music, or literature

(John & Srivastava, 1999)

Appendix F: Cognitive Test Anxiety Scale – Second Edition

Please rate each of the following statements using the scale provided. Select the option that best describes your own opinion of what is generally true for you

1 – Not at All Typical of Me
2 – Somewhat Typical of Me
3 – Quite Typical of Me
4 – Very Typical of Me

1. I lose sleep over worrying about examinations.
2. I worry more about doing well on tests than I should.
3. I get distracted from studying for tests by thoughts of failing
4. I have difficulty remembering what I studied for tests
5. While preparing for a test, I often think that I am likely to fail.
6. I am not good at taking tests.
7. When I first get my copy of a test, it takes me a while to calm down to the point where I can begin to think straight.
8. At the beginning of a test, I am so nervous that I often can't think straight.
9. When I take a test that is difficult, I feel defeated before I even start.
10. While taking an important examination, I find myself wondering whether the other students are doing better than I am.
11. I tend to freeze up on things like intelligence tests and final exams.
12. During tests, I find myself thinking of the consequences of failing.
13. When I take a test, my nervousness causes me to make careless errors.
14. My mind goes blank when I am pressured for an answer on a test.
15. During tests, the thought frequently occurs to me that I may not be too bright.
16. During a course examination, I get so nervous that I forget facts I really know.
17. I do not perform well on tests.
18. During tests, I have the feeling that I am not doing well.
19. I am a poor test taker in the sense that my performance on a test does not show how much I really know about a topic.
20. After taking a test, I feel I should have done better than I actually did.
21. My test performances make me believe that I am not a good student.
22. I often realize mistakes I made right after turning in a test.
23. When I finish a hard test, I am afraid to see the score.
24. I don't seem to have much control over my test scores.

(Thomas et al., 2017)